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PARKA II (U)

26 June 1969

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26 June 1969

From: Assistant Oceanographer for Ocean Science
To: Distribution List

Subj: PARKA II Experiment Scientific Plan (ONR Scientific Plan 2-69); forwarding of

Ref: (a) CNO ltr Ser 001500P70 of 21 Apr 1969
(b) CINCPACFLT ltr Ser 31/00506 of 12 May 1969 (First End. to CNO ltr Ser 001500P70 of 21 Apr 1969)

1. The PARKA II Experiment is the second of a continuing series of long range acoustic propagation experiments designed to support the advanced development objectives of the Long Range Acoustic Propagation Project (LRAPP) (R24-08). It will be conducted in the Pacific Ocean area north of Hawaii during the period July through December 1969. As in the PARKA I Experiment, PARKA II will be conducted by various Navy and civilian organizations with the support of Navy fleet units. PARKA II will be uniquely different from PARKA I in that it will be centered about the deep moored, sensor platform called SEA SPIDER.

2. By references (a) and (b) COMASWFORPAC has been tasked to provide Navy fleet support to PARKA II. The PARKA II Scientific Plan (ONR Scientific Plan 2-69) will constitute the concept of operations, the detailed scientific experiments and the basis of the Operations Order which COMASWFORPAC will promulgate in support of the PARKA II Experiment.

3. The PARKA II Scientific Plan is forwarded herewith for planning purposes and for execution in accordance with the Operations Order to be promulgated by COMASWFORPAC.

J. B. Hersey
J. B. HERSEY
Deputy

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PARKA II EXPERIMENT

UTILIZING

SEA SPIDER.

ONR-Scientific Plan 2-69.

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TABLE OF CONTENTS

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SECTION II (CONT'D)

I. INTRODUCTION

A. BACKGROUND

1. (C) The PARKA Experiments are a series of acoustic-environmental experiments conducted under the Long Range Acoustic Propagation Project (LRAPP) for the purpose of evaluating and improving the Navy's capability ~~within the Navy~~ to predict acoustic processes based on oceanic parameters. PARKA is an acronym for Pacific Acoustic Research Kaneohe - Alaska since these experiments are conducted in the ocean area north of Hawaii.

2. (C) PARKA I was conducted in the summer of 1968 along a track due north from Kaneohe to Alaska utilizing the research platform FLIP as the primary acoustic signal receiver platform, associated with USNS SANDS as the signal processing ship. Other oceanographic ships and aircraft obtained concurrent environmental measurements. In PARKA I a wealth of simultaneous acoustic and oceanographic data were obtained along a 2,000 mile track due north from Kaneohe. These were used to improve and validate the Fleet Numerical Weather Central (FNWC) model of propagation loss as a function of range. In addition, the data revealed that there is an optimum depth of receiver for given operational conditions.

3. (C) PARKA II is designed to extend the (PARKA I (1968)) long range acoustic environmental model research over a larger geographic area, using a greater variety of acoustic paths, and to test the concept of utilizing a deep moored platform -- "SEA SPIDER" ~~(Figure 1)~~, for supporting acoustic and environmental sensors. In addition to propagation loss measurements, the coherence of signals at pairs and at groups of receivers will be investigated as a function of spacing, time and position in the ocean. Details of SEA SPIDER are provided in Section I.E.

B. OBJECTIVES

1. (C) The objectives of the PARKA II Experiment are to:

a. Determine the optimum receiver depth for best acoustic reception under various environmental conditions.

b. Increase the scope of the validation of the acoustic prediction model applied in PARKA I by utilizing various acoustic paths, including:

(1) Acoustic paths without a sharp rise in axis of the sound channel (east-west)
(2) Acoustic paths along a descending sound axis (north-south)
(3) Acoustic paths containing blockage (seamount interference)
(4) Acoustic paths over longer ranges than in PARKA I

c. Examine the interrelationships of acoustic signals received at several hydrophones, and the variability of these relationships with respect to time; with respect to hydrophone spacing; and with respect to hydrophone locations in the ocean.

d. Investigate the capabilities of the SEA SPIDER structure as a platform for acoustic and oceanographic sensors.

C. GENERAL CONCEPT

1. (U) The PARKA II Experiment will commence with a detailed bathymetric survey of the proposed SEA SPIDER site. This survey will be conducted by USNS SANDS and will be centered at 27°31.6'N 157°44'W.

2. (U) After determination of the precise topography of the area, implantment operations for SEA SPIDER will begin. Implantment will be carried out by M/V RIGBUILDER with support from USNS SANDS and USS MARYSVILLE. The entire operation should be completed in less than two weeks. Immediately following implantment, SANDS will conduct a series of experiments to evaluate the performance of the instrumentation on the SEA SPIDER structure.

3. (C) The duration of the PARKA II Experiment will be approximately four months and consist of a series of acoustic experiments closely coordinated with a program of concurrent, intensive sampling of the oceanic environment.

The objectives of these experiments will be to measure acoustic propagation loss, arrival structure, temporal fluctuations and other variables as a function of range, frequency, source and receiver geometry, and to measure, concurrently, environmental factors for the purpose of validating the acoustic propagation loss prediction model.

4. (C) Acoustic signals during most of the experiments will be generated from R/V CONRAD by a towed low frequency projector and underwater explosive charges, to ranges of 300 to 1,000 miles radially on four different bearings from SEA SPIDER.

5. (C) In addition, long range acoustic propagation loss measurements will be made during a series of 2,000 to 2,400 mile flights made by P-3 aircraft dropping Mk 61 SUS charges. Great circle tracks will be flown from SEA SPIDER to each of the following points: San Diego, Seattle, due North to Alaska, and Adak.

6. (C) Primary receivers for all acoustic events will be the hydrophones mounted on SEA SPIDER. During certain events, bottom-mounted hydrophones at NAVFAC ADAK and the MILS hydrophones at Kaneohe will also be utilized.

7. (C) All acoustic data received by SEA SPIDER will be telemetered by VHF link to SANDS for processing, plotting and analysis. All ships will transmit oceanographic data to the Operation Control Center (OCC) located at ASWFORPAC Headquarters on Ford Island, Pearl Harbor Naval Base. From there it will be passed to Fleet Weather Central (FWC), Pearl Harbor for digitization and transmission to the computers at FNWC, Monterey. This procedure will enable FNWC to update predictions of acoustic propagation loss made prior to the commencement of the experiment which were based on archival oceanographic data.

8. (C) When required, FNWC will make available to the Chief Scientist updated propagation loss predictions, as well as sound velocity data computed from recent oceanographic data collected by PARKA ships. This data will be sent via secure line to FWC Pearl, and will be handcarried to the OCC. The methods to be used for the radio transmission of acoustic data between the OCC and SANDS are contained in Annex H.

9. (U) Monster Buoy, a large, oceanographic-atmospheric sensor buoy, is located approximately 1,000 n.m.

north of SEA SPIDER. Environmental data, received via automatic readout at Scripps Institution of Oceanography, will be provided to FNWC, Monterey, as part of the information processed in the PARKA II Experiment.

10. (U) The PARKA II Experiment has been divided into five distinct phases. Each phase is summarized in Section II. Details of the experiments which are to be conducted during each phase are contained in Annex E.

D. COMMAND AND CONTROL

1. Participants

(U) PARKA II is a cooperative exercise involving the following Navy and civilian activities and their ships/platforms:

Activity	Ship/Platform
Office of the Oceanographer of the Navy	--
Office of Naval Research	SEA SPIDER
Navy Underwater Sound Laboratory	USNS SANDS
Naval Research Laboratory	--
Naval Undersea Research and Development Center	USS REXBURG, USS MARYSVILLE
Naval Oceanographic Office	--
Anti-Submarine Warfare Force, Pacific	--
Fleet Air Wing TWO	Aircraft
Fleet Numerical Weather Central	--
Fleet Weather Central, Pearl Harbor	--
Lamont-Doherty Geological Observatory	R/V CONRAD
Marine Physical Laboratory	--
Hawaii Institute of Geophysics	R/V MAHI
Scripps Institution of Oceanography	Monster Buoy
Bell Telephone Laboratories, Inc.	--

2. Scientific Organization

(U) The responsibility for the scientific planning and execution of PARKA II is as follows:

J. B. Hersey, Deputy Assistant Oceanographer for Ocean Science; Manager, LRAP Project
R. H. Nichols, BTL - Chief Scientist

R. W. Hasse, USNUSL - Deputy Chief Scientist
A. J. Hiller, NRL - Project Coordinator
K. W. Lackie, NAVOCEANO - Scientist in Charge of Oceanographic Operations
J. B. Gregory, ONR - SEA SPIDER Project Manager

a. Under the general guidance of the LRAP Project Manager, the Chief Scientist and Deputy Chief Scientist are responsible for overall planning, detailed experimental design, direction of the field experiments, furnishing of information for daily situation reports and analysis and publication of the experimental results.

b. The Project Coordinator is on the staff of the LRAP Project Manager and is responsible for administrative and other details necessary to coordinate the various operations of the PARKA II Experiment. He assists the Chief Scientist in preparing and executing the Scientific Plan and is responsible to him in matters related to logistics, the scientific radio net, and shore support for the non-Navy participants during all phases of the experiment.

c. The Scientist in Charge of Oceanographic Operations is responsible for planning and coordinating oceanographic measurements and processing, transmitting and analyzing the data.

d. The SEA SPIDER Project Manager is responsible for contract supervision of implantment and maintenance of the SEA SPIDER structure.

e. Each ship participating in the experiment will have a senior scientist on board (SSOB) who is responsible to the PARKA II Chief Scientist for the scientific tasks assigned to his ship/activity. A directory of the senior scientists on board is given in Annex J.

3. SEA SPIDER Technical Responsibility

(U) a. Responsibility for operations is dependent upon the nature of the operations during the various phases of the experiment. The SEA SPIDER implantment which occurrs during Phase II will be performed by IEC/AC-DRL under the general contract supervision of the SEA SPIDER Project Manager, Mr. J. B. Gregory, ONR Code 485.

Upon completion of this phase, maintenance of the SEA SPIDER moor will remain with the SEA SPIDER Project Manager who is represented in the area by the senior Interstate Electronics Corporation diver/technician, who will normally be stationed aboard SANDS and will initiate daily situation reports and any casualty reports on the moor via the SSOB to the OCE. (See Section II E; SEA SPIDER Monitoring and RTG Accountability.) In addition the senior diver/technician will keep the SSOB appraised of the operating status of the moor and monitoring equipment to preclude unnecessary delays which may effect the experiment.

4. (U) Navy Support

A CNO Research Assistance Project, Fleet Research Investigation F/R 109, has been assigned to provide fleet support for the operational phases of the experiment. Under F/R 109 COMASWFORPAC will promulgate the Operations Order to provide Navy support for the experiment objectives. Among the support items that will be required are: coordination of units involved, communication facilities, operation control center, special shore support, assignment of the Officer in Tactical Command (OTC)/Officer Conducting the Exercise (OCE); coordination of action in event of intrusion of SEA SPIDER site; and Immediate Action Commander for nuclear power device accidents.

5. (U) Operation Control Center

The Operation Control Center (OCC) will be located at ASWFORPAC Headquarters, Ford Island, Pearl Harbor. All aspects of the operation will be coordinated from the OCC by the Chief Scientist, Dr. R. H. Nichols; the OCE (ASWFORPAC Representative); the Project Coordinator, Mr. A. J. Hiller; and the Scientist in Charge of Oceanographic Operations, Mr. K. W. Lackie.

6. (U) Ship Control

The OCE will control all Navy units and, by agreement, the non-Navy units involved in the coordinated operation. Requests from the Chief Scientist for changes in Navy support will be made to the OCE. The Chief Scientist will advise the OCE of any changes in scheduling of non-Navy units set forth in the Scientific Plan as far in advance as possible.

7. (C) Shore Support

a. Docking, storage and work areas, supply services and shipyard services will be provided by and coordinated through ASWFORPAC.

b. Electronics assistance, particularly in establishing non-Navy radio communications and certain aspects of data telemetry, will be furnished by Hawaii Institute of Geophysics, under the direction of Mr. Noel Thompson.

c. During the long-range aircraft flights, magnetic tape recordings will be made of the SUS charge drops at NAVFAC ADAK. In order to obtain the proper data, the outputs of selected hydrophones in the ADAK array, and the use of impulse processing gear located at the NAVFAC has been requested. This assistance will be required during the period commencing one week before the start of Phase V, and ending one week after the completion of Phase V. In addition, assistance of the local resident engineers at NAVFAC ADAK has been requested for this period.

d. Access to the outputs of Kaneohe MILS hydrophones will be required, intermittently, on a not-to-interfere basis, during the interval 1 September through 1 December 1969, along with occasional technical assistance from a PMR Kaneohe technician for calibrations. These outputs are available at the PARKA Operation Control Center at ASWFORPAC Headquarters, Ford Island.

E. SEA SPIDER DESCRIPTION

1. (U) SEA SPIDER, Figure 1, is an ultra-stable deep ocean moor or platform which supports oceanographic and acoustic sensors. It is located at 27°31.6'N; 157°44'W.

2. (U) The platform is a tensioned hydrostructure, the buoyant force for which is supplied by the 14 foot diameter ellipsoidal subsurface float positioned 100 feet below the surface. This float has a positive buoyance of 26,000 pounds and loads each leg to about forty percent of its breaking strength. Over 3,000 hollow glass spheres are mounted on the three legs making the legs neutrally buoyant, and preventing the formation of catenaries. Cylindrical anchors with a multiplicity of flukes, weighing 23,000 pounds each, prevent the moor from dragging due to

Fig. 1 - PACIFIC SEA SPIDER
Deep ocean acoustic and oceanographic stable platform

ocean currents or the buoyant force of the subsurface buoy. The legs are two-thirds inch diameter double armored coaxial cables.

3. (C) There are ten hydrophones on each leg of the structure at depths ranging from 150 to 18,000 feet. On two legs several of the hydrophones are grouped in small arrays to allow measurements of signal coherence. Twelve temperature sensors are distributed along the legs at depths down to 2,500 feet. At the bottom of each leg there is a remotely energized acoustic projector which can be used to test hydrophone response or determine relative hydrophone positions and structure motions.

4. (U) The electrical signals from the hydrophones and temperature sensors are multiplexed and transmitted by hard wire to the subsurface buoy. There they are processed and sent via an umbilical cable to a radio transmitter mounted in the surface buoy. The signals are then radio telemetered from the surface buoy to a nearby data collection ship.

5. (U) In addition to the acoustic and oceanographic data, leg tensions, current vectors measured below the subsurface buoy, and certain leg vibration information are transmitted continuously via the VHF link. Three twenty-five watt radioisotope thermoelectric generators (RTG's) are mounted inside the subsurface float to provide power for these transmissions. While this nuclear power supply is sufficient for the continuous use of the short range VHF link, it only provides enough power for hourly transmissions of certain temperature and engineering data over the 350-mile range HF link. Since acoustic information will not be transmitted over the HF link, this link will be utilized primarily for long-range monitoring of the status of the moor.

6. (U) In addition to transmitting data, the surface buoy antennas can receive commands from the monitor ship to change the monitoring of hydrophones and temperature sensors, activate the acoustic projectors, adjust gain settings, and blow explosive bolts which separate the legs from the anchors for recovery of the moor.

7. (U) SEA SPIDER was designed to be maintenance-free over a two-year period. However, if the electronics inside the subsurface buoy require attention, or modifications are desired, a diver may enter the buoy through a

bottom-fitted access hatch in order to plug in a spare canister of electronic equipment. In addition, if the surface buoy should break loose from the subsurface float, a spare surface buoy can be attached by a team of divers. Periodic maintenance can be performed by divers after the maintenance cycle has been established after implantment in August. They will begin at the surface float and inspect the moor down to where the legs are connected to the subsurface buoy. Procedures for entering the subsurface float are contained in Section II E.

8. (U) Stability of the platform can be determined by use of all the sensors on the moor. In particular, the acoustic projectors mounted near each anchor will be used to transmit pulses through the water to the various hydrophones; by measuring the relative travel times, the positions of the hydrophones (hence, the legs) will be determined.

II. OPERATIONS

A. (C) INTRODUCTION

PARKA II will be conducted in five distinct phases. During each phase, specific tasks designed to accomplish the various objectives of the experiment will be conducted. In some instances, the individual events will be carried out simultaneously. The table below provides a summary of the activity during each phase of the experiment.

1. Table of Phases and Events

PHASE & DATE	DESCRIPTION OF EXPERIMENTS	*EVENTS ANNEX G	PARTICIPATING UNITS
I 21 Jul- 5 Aug	a. Bathymetric Tracks	1	SANDS, CONRAD, MARYSVILLE
	b. SEA SPIDER Site Survey	2	
II 13 Aug- 3 Sep	a. SEA SPIDER Implantment	3	SANDS, MARYSVILLE RIGBUILDER
	b. SEA SPIDER Performance	4	
	c. SEA SPIDER Motion Studies	5	
	d. Calibration of Receiving System	6	
	e. Noise Measurements	7	
3 Sep- 10 Sep	SEA SPIDER Surveillance	-	MAHI
III 10 Sep- 3 Oct	a. Motion Studies	5	SANDS, CONRAD, MARYSVILLE, Aircraft
	b. Calibration of Receiving System	6	
	c. Noise Measurements	7	
	d. Optimum Array Gain	8	
	e. Propagation Loss & Arrival Structure	9	
	f. Satellite Transmission of Acoustic Data	10	
3 Oct- 8 Oct	SEA SPIDER Surveillance	-	MAHI
IV 8 Oct- 28 Oct	a. Calibration of Receiving System	6	SANDS, CONRAD,

Table of Phases and Events (Cont'd)

PHASE & DATE	DESCRIPTION OF EXPERIMENTS	*EVENTS ANNEX G	PARTICIPATING UNITS
	b. Satellite Transmission of Acoustic Data	10	MARYSVILLE, REXBURG, Aircraft
	c. Propagation Loss & Temporal Fluctuation of CW Signals	11	
28 Oct-4 Nov	SEA SPIDER Surveillance	-	MAHI
V 4 Nov-29 Nov	a. Motion Studies	5	SANDS, CONRAD, MARYSVILLE REXBURG Aircraft
	b. Calibration of Receiving System	6	
	c. Optimum Array Gain	8	
	d. Satellite Transmission of Acoustic Data	10	
	e. Temporal Fluctuations & Coherence	12	
	f. Long Range Propagation Loss (A/C)	13	
	g. Bottom Loss	14	
	h. Reverberation Characteristics	15	
29 Nov-20 Dec	SEA SPIDER Surveillance	-	MAHI

In addition to visual surveillance of SEA SPIDER by MAHI, SANDS will continuously monitor moor sensor outputs at all times, whether on the scene or in port. Relief of MAHI after Phase V will be worked out prior to the completion of the PARKA II Experiment.

*These EVENT numbers refer only to the individual scientific experiments to be conducted during PARKA II; these are detailed in Annex E.

B. (C) PHASE DESCRIPTIONS

The activities conducted by the various units in PARKA II during each of the five phases are described below. Detailed descriptions of experiments to be conducted in each phase are given in Annex E; ship and aircraft schedules are given in Annex G.

1. (U) Phase I: 21 July - 5 August 1969

This is the preparatory phase for the PARKA II Experiment during which certain essential tasks associated with the experiment will be conducted. A summary of the activities during this phase is as follows:

a. Preparatory activity will take place at COMASWFORPAC Headquarters on Ford Island. The Chief Scientist, Project Coordinator, Scientist in Charge of Oceanographic Operations and OCE/OTC will establish the PARKA II Operation Control Center (OCC) at ASWFORPAC, HQ, and establish liaison with FWC Pearl; FNWC, Monterey; COMFAIRWING TWO; PMRF Kaneohe and Hawaii Institute of Geophysics (HIG). HIG will install the radio equipment for the scientific network at the OCC and on PARKA II ships and conduct radio checks through OCC with all participants.

b. SANDS will conduct a bathymetric survey along the great circle course from San Diego to the SEA SPIDER site. SANDS will then conduct a five-day bathymetric survey of the site where SEA SPIDER is to be implanted and, using satellite navigation, locate and determine the exact positions and depth for the SEA SPIDER anchors. Upon SANDS' return to Hawaii, after the five-day survey, scientists who conducted the survey will brief the SEA SPIDER implanting team.

c. RIGBUILDER, the primary SEA SPIDER implanting ship, will be enroute to Pearl Harbor and upon arrival make final preparations and systems checks prior to installing SEA SPIDER on the designated site.

d. MARYSVILLE will conduct a bathymetric survey along the great circle route from Seattle to the SEA SPIDER site.

2. (U) Phase II: 13 August - 3 September 1969

a. SANDS will recheck navigational coordinates, water depth, and surface currents at the three anchor positions for the SEA SPIDER. She will then assist RIGBUILDER in the implantment. Immediately after implantment, SANDS will make ambient noise measurements and obtain temperature data using AUTOBUOY. The data will serve as a reference for similar data obtained from the temperature sensors and hydrophones on SEA SPIDER. The SEA SPIDER

Command and Control System will be checked out and the range of effective telemetry determined. Acoustic and engineering data will be collected and analyzed using the computer facilities on SANDS. In addition, SANDS will conduct several other experiments to test and calibrate the instrumentation on SEA SPIDER, and determine the stability of the moor.

b. RIGBUILDER will drop the free-fall mooring system and proceed with the implanting of the SEA SPIDER legs as described in Annex B.

c. MARYSVILLE will collect oceanographic data and serve as a patrol ship during the entire phase.

d. The services of a Coast Guard patrol craft with helicopter have also been requested for this phase to provide observation of the implantment operation and serve as a camera platform for a motion picture documentary being produced by the Oceanographer of the Navy.

e. CONRAD will conduct a detailed bathymetric survey along the ADAK - SEA SPIDER great circle track.

3. (C) Phase III: 10 September - 3 October 1969

The initial acoustic experiments of PARKA II will be conducted during this phase using SEA SPIDER as the sensor platform. All of these will be relatively short range acoustic experiments.

a. SANDS, the primary data processing unit, will receive and process acoustic, environmental, and engineering data from SEA SPIDER via the telemetry link. The acoustic experiments will include the measurement of acoustic propagation loss, arrival structure, and array gain of the SEA SPIDER hydrophones. SANDS will also attempt to relay

acoustic data as received from SEA SPIDER to CONUS via satellite during the CONRAD's fourth shot run.

b. CONRAD will be the source ship of acoustic signals during this phase. She will drop explosive charges along six radial runs 500 miles long and one radial run 330 miles long. These seven runs will be along four tracks bearing 000°T, 060°T, 180°T, and 240°T from SEA SPIDER. A round trip will be completed on all four tracks except the one due south of SEA SPIDER, which will be run only in the northerly direction. The first run will be on the 000°T heading and starts at 22°N; 157° 44'W. Three-pound TNT charges, set for 60 feet and 500 feet detonation, will be dropped, alternately, every two minutes. CONRAD will proceed at 10 kts on all shot runs. Shot indexing (detonation time) will be indicated by radio CW tone cut off activated by the explosion. CONRAD will make XBT observations and collect bathymetric profiles during these runs.

c. MARYSVILLE will provide oceanographic data in support of this phase of the experiment by taking sound velocity profile stations along the same tracks on which CONRAD is making shot runs. MARYSVILLE starts the first run twelve hours before CONRAD. MARYSVILLE will occupy four stations at 100-mile intervals from SEA SPIDER to a range of 400 miles on all runs except Run 1 from 22°N, on which only three stations will be occupied. She will take a total of twenty-six stations as described in the detailed schedule for MARYSVILLE. During transits between stations she will take XBT's every six hours.

d. Aircraft will provide support in PARKA II during this phase, through the use of air-dropped expendable bathythermographs (AXBT's). P-3 aircraft will drop AXBT's along each of the four tracks on which CONRAD is dropping explosives. Drops will be made every 25 miles to a distance of 500 miles from SEA SPIDER on three tracks, and a distance of 330 miles on the track south of SEA SPIDER. AXBT drops will be made while the research ships are on one of the runs along the particular track (about every four or five days).

4. (C) <u>Phase IV: 8 October - 28 October 1969</u>

During this phase the experiments will be devoted to measuring the propagation loss and temporal fluctuation of received energy from CW sources, and

measuring the correlation of signals received by various hydrophone combinations on SEA SPIDER. A summary of the activities during this phase follows:

a. SANDS is the primary data processing unit. Some of the acoustic data will be relayed by satellite to the U.S. Navy Underwater Sound Laboratory and the U.S. Naval Research Laboratory for processing.

b. CONRAD is the source ship and will tow a CW source in both directions along the same four tracks described above in Phase III. An explosive charge will be detonated every hour for range indexing and XBT's will be dropped every six hours. Bottom profiles will again be collected along all tracks.

c. MARYSVILLE will collect sound velocity profiles at 28 stations in the same manner as during Phase III.

d. REXBURG will take XBT's every six hours while obtaining temperature/depth information continuously by towing a thermistor chain along the same CONRAD and MARYSVILLE tracks. The schedule for the three ships provides for both MARYSVILLE (sound velocity structure) and REXBURG (temperature-depth-measurements) to be between CONRAD (source ship) and SEA SPIDER (receiver) in order to sample the environmental conditions affecting acoustic propagation.

e. Aircraft will provide AXBT support in the same manner as in Phase III.

5. (C) <u>Phase V: 4 November - 29 November 1969</u>

During this phase the long range acoustic propagation experiments will be carried out using air-dropped explosive sound signals (SUS) along great circle tracks from SEA SPIDER to Adak, to Seattle, to a point due north in Alaska, and to San Diego. SUS charges will be dropped every eight miles along these tracks, detonating at a depth of 60 feet on outbound runs from SEA SPIDER, and at 800 feet during the return runs. AXBT's will also be launched every 25 miles on outbound runs only. The optimum array gain experiment described under Phase III will be

repeated as well as CW signal fluctuation and correlation studies similar to those described in Phase IV. Satellite transmission of acoustic data is again planned. Time will also be devoted to measuring the reverberation charactererístics of the ocean area near SEA SPIDER through the detonation of several large explosive charges. Bottom loss as a function of frequency and grazing angle will be measured using explosives dropped from CONRAD. Details of the experiments to be conducted during this phase are contained in Annex E; a summary follows:

a. SANDS will perform data acquisition and reduction of signals received by SEA SPIDER in connection with propagation loss, signal fluctuation, correlation, bottom loss, and optimum array gain measurements.

b. CONRAD will serve as the CW source ship along a track running from 330 miles south to 1,000 miles north of SEA SPIDER. The source will be lowered to depths of 60 and 500 feet at 12 stations along the track. XBT's will be dropped every six hours and bathymetric profiles will be recorded.

c. Aircraft will fly four round trip great circle tracks from SEA SPIDER to Adak, Alaska (due north), Seattle, and San Diego. MK 61 SUS charges will be dropped in both directions; AXBT's, will be dropped on the outbound runs only.

d. MARYSVILLE will occupy 12 stations along the track at positions approximately half way between CONRAD and SEA SPIDER. Time on each station will be about 18 hours, during which sound velocity profiles will be obtained.

e. REXBURG will tow the thermistor chain from SEA SPIDER to 46°N Lat.

f. Adak hydrophones will be manned by Bell Telephone Laboratories and Western Electric engineers during the Adak A/C run only. They will make recordings of the Adak hydrophone outputs and reduce and analyze the acoustic propagation data.

C. (U) COMMUNICATIONS

1. Radio communications among all ships,

aircraft and the Operation Control Center (OCC) will be provided via assigned nets. The "Scientific Radio Net" will be the primary civilian means of communicating and handling data between OCC and ships and aircraft. It will comprise an SSB transmitter-receiver set in each ship and at the OCC. Regular Navy communications will also be provided between the OCC and the Navy ships and aircraft in the exercise. Assigned Navy frequencies will be used by all participants in the exercise for voice communications. COMASWFORPAC Operation Order will identify these frequencies.

2. Due to the classified nature of certain acoustic information as related to operating modes of SEA SPIDER and the experiment geometry, it is required to pass such information by coded transmission. Since not all participants are involved in the transmittal of such information,an encryption system will be forwarded only to selected personnel on SANDS, CONRAD MARYSVILLE, and the OCC. Word equivalents which reveal "modus operandi" andtables for the operational configuration of SEA SPIDER in the PARKA II Experiment will be included in a special annex (M).

D. DATA HANDLING

1. (U) Oceanographic Data

a. All oceanographic data collected from ships (SBT, STD, sound velocimeter, etc.) will be plotted and coded at sea after the completion of an observation. Data plotting formats are specified in Annex L, and coding and transmission procedures are outlined in Annex H. All ships will maintain daily radio contact with the OCC and will pass data messages by voice via the Scientific Radio Network to OCC personnel. From there they will be sent by teletype to FWC, Pearl Harbor, for relaying to the computer located at FNWC, Monterey, California. FNWC will compute sound velocity profiles from the raw data and will transmit these back for use by OCC personnel.

b. The only oceanographic data to be collected from aircraft during PARKA II is aircraft expendable bathythermograph (AXBT) information. AXBT data will be handcarried from Barbers Point NAS to FWC, Pearl Harbor for digitization and analysis. A complete description of the procedures to be followed is contained in Annex F.

2. (C) Acoustic Data

a. SANDS will receive continuous acoustic data via telemetry link from SEA SPIDER during the acoustic runs. When required, selected portions of these data will be transmitted in an appropriate code in accordance with Annex H, to the OCC via the Scientific Radio Network.

b. When required, FNWC will update a prediction of acoustic propagation loss based on recent environmental information. These predictions will be sent via a secure line to FWC, Pearl Harbor, where they will be handcarried to the OCC for analysis and comparison with measured results. This same secure line can be used to transmit observed acoustic data to FNWC.

c. All processed acoustic data are classified CONFIDENTIAL and will not be transmitted in the clear. The guidance for transmission of classified information is given in Annex H.

E. (U) SEA SPIDER MONITORING AND RTG ACCOUNTABILITY

1. (U) Introduction:

a. After Phase II, the SEA SPIDER implantment vessel, RIGBUILDER, and the contractor and ONR implantment personnel will depart the area leaving the operation of the SEA SPIDER moor with contractor representatives aboard the USNS SANDS. These representatives are four, factory-trained, Interstate Electronics Corporation technicians who are qualified divers. They are charged with operation and maintenance of monitoring equipment and with the inspection and maintenance of the moor. Their operations are coordinated through the PARKA II Senior Scientist on board SANDS in their working relations with the Master of SANDS, the Chief Scientist, the OCE and ONR. The diver-technicians for the PARKA II Experiment will follow diving procedures approved by the Navy Supervisor of Salvage. Although a medical doctor who is a qualified diver will be at the scene during the implantment phase, there will be no doctor on board during the subsequent phases. However, all divers are qualified to operate the decompression chamber. They will make inspection dives on the moor at their discretion, when concurred in by the Senior Scientist and Master of SANDS, to fulfill contractor requirements in support of PARKA II. All equipment necessary for their

operations, including a diver decompression chamber, shark cage and radiological monitoring equipment are aboard SANDS.

b. The technicians will make daily situation reports and casualty reports to the OCE, via the Senior Scientist on SANDS. The OCE will forward the reports to ONR Codes 102-OS, 400C, 485 and USN/USL Codes 2210 and 7000.

c. The Atomic Energy Commission (AEC), when issuing the license for RTG operations, requires that the status of the moor be observed daily to ascertain its integrity; in the event of a casualty, immediate action is to be taken to retrieve the nuclear generators. This daily observation is accomplished through VHF/HF telemetry and visual observation by ships on station. A monitoring ship will be on station at all times. When the monitoring ship, USNS SANDS, returns to port, the relief vessel, R/V MAHI, with HF monitoring capability will replace SANDS. To supplement MAHI's monitoring, SANDS will maintain HF radio monitoring of SEA SPIDER at all times, including time in transit and in port.

d. When SANDS departs SEA SPIDER for port, she will command the SEA SPIDER to switch from the VHF to the HF telemetry. This latter telemetry link is primarily for monitoring the mechanical-electrical status of the moor.

e. If the surface buoy parts from the subsurface buoy during VHF link operation, the buoy will automatically switch to the HF link and transmit the parted painter alarm.

f. When in the HF telemetry mode of operation, a parted surface buoy painter will be indicated by the loss of HF link data and the attendant beacon mode of operation of the buoy.

2. (U) <u>Normal Operations and Monitoring of the SEA SPIDER Moor</u>:

a. <u>USNS SANDS on Station</u>:

(1) When on station during PARKA II, SANDS will be within five to seven miles of moor center operating with SEA SPIDER via the VHF data telemetry link. The telemetry link provides data output of all acoustic, oceanographic and engineering sensors continuously. This

data is printed in engineering units aboard SANDS. The engineering data received over the telemetry link provides an indication of the mechanical-electrical status of SEA SPIDER. The engineering information is as follows:

(a) Temperature (7 channels).
(b) Subsurface buoy depth.
(c) Current velocity at subsurface buoy.
(d) Current direction at subsurface buoy.
(e) Tensions on each of the three legs.
(f) Voltage and current from RTG's to DC-DC converter.
(g) Total electrical current delivered to spider legs.
(h) Time of day.

(2) In addition to the above channels of data, there are two aural alarms in SANDS. These are:

(a) RTG short circuit.
(b) DC-DC converter failure.

(3) Weather permitting, the surface buoy of SEA SPIDER will be in view from SANDS and will provide visual indication of the SEA SPIDER status.

b. MAHI Replaces SANDS on Station:

Between phases MAHI will replace SANDS at the moor site and will remain within visual range. Her duties will be to monitor HF telemetry, observe the moor and to warn off vessels which appear to steam toward it. Since MAHI will not have a computer on board to convert HF data to engineering units, she will be furnished a conversion table to enable her to convert the digital data to the engineering units. The engineering information obtained in this manner is the same as that listed in 2a(1) above.

3. (U) Inspection and Maintenance:

a. Diver-technicians on SANDS will make all normal inspections of the SEA SPIDER moor and perform all routine maintenance while SANDS is on station.

b. Diver inspection will be performed at about two-three week intervals until sufficient experience is obtained to warrant an increase or decrease in the inspection frequency. Such inspections will allow preventive maintenance to be accomplished as well as inspections of the surface buoy, its mechanical tether and electrical umbilical. Divers will descend along the surface buoy tether to the subsurface buoy, clearing sea growth as they progress doenward. At the subsurface buoy, they will clean off the two navigation lights and current meter and check the mechanical leg terminations.

c. No attempt will be made to enter the buoy during routine inspections without permission from ONR (Code 485).

d. Inspections of the moor which reveal no signs of abnormalities will be reported in divers' daily situation reports in accordance with Annex K. These reports will contain the following information:

(1) Degree of marine fouling on moor.
(2) Prevalence of sharks.
(3) Significant diver difficulties.
(4) Monitoring equipment malfunctions.

e. If abnormalities are observed visually as a result of diver inspection or by telemetry, a casualty report will be sent immediately in accordance with Annex K. Repairs which are normally accomplished without entering the subsurface buoys, such as replacement of the surface buoy, may be effected without consulting ONR for permission. However, should more serious casualties be detected, repair action should await ONR reply to a casualty report. Serious casualties are defined as damages to the moor which impair its integrity and require a determination concerning its repair or salvage. Examples of some of the types of casualties which should be reported to ONR for decision are:

(1) Excessive wear of mooring cables [illegible]or connections at the subsurface buoy.

(2) Dents in the subsurface buoy.
(3) Failure or impending failure of a moor leg.
(4) Increase in depth of subsurface buoy from any cause.
(5) Excessive tension in any moor leg.

f. Divers shall not enter the subsurface buoy without permission from the ONR SEA SPIDER Project Manager, when such casualties as the above occur.

4. (U) <u>Radiological Safety</u>:

Because the RTG's installed in the subsurface buoy are radioactive, precautions must be taken to ensure that personnel working in the vicinity of the RTG's do not receive excessive radiation. Radiation limits and monitoring are described in Annex C. In addition, procedures must be established to detect leakage of radioactive fuel in the event the RTG's are damaged. The AEC has established radiation limits of nuclear power devices and requirements for the accountability of these devices.

a. <u>Naval Nuclear Power Unit</u>: The Naval Nuclear Power Unit (NNPU) is responsible to AEC for ensuring that Navy activities using nuclear power devices meet the requirements established by AEC. The NNPU, therefore, provides the Navy activity using such devices with guidance for safe operation, procedures to be observed in the event a nuclear power unit is damaged, and guidance to ensure the accountability of RTG's.

b. <u>Radiation Limits</u>: Annex C, Radiological Safety, provides a detailed description of the radiation limits established for PARKA II and related inspection procedures. The administrative radiation limits described in Annex C are limits established by NNPU which are less than the AEC absolute radiation limits. The administrative limits, therefore, provide the NNPU with the flexibility to extend the amount of radiation received by working personnel, up to the AEC limit, to permit personnel to carry out urgent tasks, and at the same time provide NNPU with the control over radiation exposure which it requires.

c. <u>RTG Accountability</u>: Accountability for the RTG's installed in the SEA SPIDER is part of the radiological safety required by AEC. Accountability is necessary

Table II-1

Courses of Action for Integrity of Moor Casualty (U)

CASUALTY	ACTION: SANDS on Station	ACTION: MAHI on Station	Remarks
(a) Surface Buoy Tether Parts This condition will occur if tether fails from fatigue. Symptoms No HF/VHF data transmission. Acoustic beacon activated. Surface buoy drifts.	1. Notify OCE; OCE keep ONR informed.	1. Notify OCE; OCE keep ONR informed.	
	2. Verify subsurface buoy position by use of portable sonar interrogator.	2. Verify subsurface buoy position by use of spare sonar interrogator.	Parting of surface buoy tether probably would not be associated with other failure of moor.
	3. Inspect subsurface buoy and connect spare surface buoy assembly.	3. OCE directs SANDS to proceed to SEA SPIDER site.	If divers report evidence of damage to moor integrity notify ONR for direction. Do not enter subsurface buoy without permission from ONR.
	4. After moor is again operable, retrieve drifting surface buoy. If unable to retrieve, request OCE provide aircraft/ship assistance.	4. Upon arrival of SANDS, divers inspect moor.	
		5. SANDS connect spare surface buoy assembly.	
		6. MAHI searches for drifting surface buoy. If unable to retrieve request OCE provide aircraft/ship assistance as feasible.	
		7. MAHI retrieves drifting surface buoy and returns to SANDS.	
		8. Proceed with experiments.	
(b) Moor Failure (Subsurface Buoy on Surface This condition will occur if one or more legs part. Symptoms Buoy depth reading and one or more tension readings decrease radically.	1. Notify OCE; OCE keep ONR informed.	1. Notify OCE; OCE keep ONR informed.	
	2. Locate subsurface buoy visually or by radar. If unable to locate OCE implement OPNAV INSTR 3040.5	2. Locate subsurface buoy visually or by radar. If unable to locate OCE implement OPNAV INSTR 3040.5	Care must be exercised in locating the subsurface buoy because of its low silhouette and possibility of parted leg cables on surface. Portable sonar interrogator cannot be used because acoustic transponder is positioned on buoy top. If one or more legs are intact, buoy will remain in general location. If the subsurface buoy surfaces, it is quite likely that it will twist the two reamining legs around each other so as to cause chafing and fatigue. To prevent this occurrence the monitor ship upon observing the surfacing of the buoy would have to take a strain on the buoy and pull the legs taut enough to prevent damage to them. She would have to maintain this thrust until the arrival of the implantment vessel. Surface buoy may remain tethered or be adrift.
	3. Approach buoy, perform diver inspection of moor.	3. Determine if buoy is moored or drifting by observation.	
	4. Erect radar reflector on buoy.	4. Keep watch on buoy. Await decision from ONR to salvage or reimplant.	
	5. Await decision from ONR concerning salvage or reimplantment. Stand by the moor to prevent further damage or loss.		In the absence of SEA SPIDER Project Manager, the senior diver-technician on SANDS will provide technical assistance to salvage forces during salvage of the moor (See Annex D)
(c) Moor Failure (Subsurface Buoy Sinks) This condition may exist if more than 3 water-tight compartments of the subsurface buoy are punctured and filled with water. Symptoms Depth limits are exceeded. Surface buoy disappears or tether parts. Loss of transmission.	1. Notify OCE; OCE keep ONR informed.	1. Notify OCE; OCE keep ONR informed.	If positive indication is obtained that the subsurface buoy is sinking based on decision of divers, then a leg of moor should be blown off to permit the subsurface buoy to surface.
	2. OCE implements OPNAV INSTR 3040.5.	2. OCE implements OPNAV INSTR 3040.5.	
	3. Interrogate subsurface buoy with portable sonar interrogator.	3. Interrogate subsurface buoy with portable sonar interrogator.	Subsurface buoy will be below diver depth. Portable sonar interrogator will indicate depth. If buoy is on bottom no salvage is contemplated.
	4. Fix geographical position.	4. Fix geographical position.	

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to ensure that the location of the RTG's is known at all times; that their location may be regained if the subsurface buoy is lost and that their location on the sea floor can be determined if the subsurface buoy sinks. In the event the subsurface buoy, with its enclosed RTG's, is not under control or damaged to the extent that the radiation level exceeds 10 milliroentgens per hour, OPNAV Instruction 3040.5 will be implemented immediately. This instruction provides procedures for initiating proper action in the event of damage or loss of nuclear power devices and establishes command responsibility for these actions. For the PARKA II Experiment, the Immediate Action Command and Primary Action Command, as defined in OPNAV Instruction 3040.5, are identified as COMASWFORPAC and CINCPACFLT, respectively. The Senior Scientist on Board a monitoring ship at the SEA SPIDER site, when damage or loss or RTG's occurs, is responsible for timely and accurate reports to the OCE. The OCE will keep the Immediate Action Command, Primary Action Command, ONR and NNPU informed. Section IIE5, below, provides the details of actions to be taken in the event of a SEA SPIDER casualty.

5. <u>Courses of Action in the Event of SEA SPIDER Casualty</u>:

a. <u>General</u>:

The actions required in the event of a failure to the SEA SPIDER are dependent upon the type of casualty which occurs. Generally, these casualties may be categorized as follows:

(1) Electronics
(2) Physical integrity of SEA SPIDER moor
(3) RTG Damage/Loss

The courses of action to be followed for each of these broad categories of casualties is provided in the following paragraphs. It is recognized that all possible casualty situations cannot be identified in advance of the experiment, therefore, complete reporting and close coordination is required among personnel at the scene and those at OCC and ONR (Codes 102-OS, 400C and 485). A casualty report containing both the diver-technician casualty estimate and Chief Scientists' evaluation will be made for each casualty to permit ONR to make a determination of the proper course of action for the situation. The OCC PARKA representative on duty will make the casualty report by phone call, followed by a message report. The

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casualty report will not be held unduly long (four hours maximum) to obtain the scientific evaluation.

b. Electronic Casualties:

Casualties to the electronic systems, such as telemetry, sensor, signal processing and tether electrical failures, could affect the conduct of the experiment during any phase. The diver-technicians and senior scientist on board SANDS will be able to determine the area of electronics failure and recommend the necessary repairs to correct the malfunction. The following action will be taken when electronic failure is detected, depending upon the requirement to enter the subsurface buoy for investigation/repair:

(1) Entry into subsurface buoy is not required:

(a) Upon determining the cause or area of electronic failure the SSOB on SANDS will inform the OCE and Chief Scientist of the problem and necessary repairs or investigation required. The Chief Scientist will determine whether or not the resulting degradation of the SEA SPIDER moor can be accepted within the framework of the scientific effort. If it can be accepted, then the experiment will continue. If it cannot be accepted, then the diver-technicians will make necessary repairs which do not require entry into the subsurface buoy.

(2) Entry into subsurface buoy is required:

(a) Upon determining that entry into the subsurface buoy is required for repair or investigation of an electronics casualty the SSOB on SANDS will notify the OCE and Chief Scientist at the OCC. The Chief Scientist will determine the effect of the casualty upon the scientific effort of the experiment. If the degradation of the system can be accepted, then the experiment will continue. If the degradation to the system cannot be accepted, the Chief Scientist (or his representative) will provide appropriate information to the OCE to be included in a casualty report to ONR (Codes 400C, 485 and 102-OS). Entry into the buoy will not be made by divers to effect repairs until permission has been obtained from the ONR SEA SPIDER Project Manager (Code 485).

c. Physical Integrity of the Moor Casualties:

(1) Casualties affecting the physical integrity of the moor require immediate action in order to:

(a) Prevent the moor from sustaining further damage.

(b) Initiate reimplantment or retrieval and salvage action.

(c) Maintain accountability of the RTG's.

(2) The actions listed in Table II-1 should be used as a guide in the event a casualty affecting the physical integrity of the SEA SPIDER moor occurs. Initiation of the actions listed in the table is the responsibility of the senior scientist embarked in the ship on station at the SEA SPIDER site; USNS SANDS during Phases III, IV, V and R/V MAHI between phases. The senior scientist in SANDS will coordinate the actions listed in the table through the SEA SPIDER Implanting Supervisor, on board RIGBUILDER during Phase II, keeping the OCE informed. Prompt casualty reports are required for casualties affecting the integrity of the moor. These reports will be made by the OCC PARKA representative on duty by phone, followed by message. See Annex D for SEA SPIDER retrieval and reimplantment guidance.

d. RTG Damage/Loss

(1) General: In the event telemetry signals are lost or casualties affecting the integrity of the SEA SPIDER moor occur (paragraph E5c above), the monitoring ship must make every effort to determine the location of the subsurface buoy/RTG's. If the subsurface buoy comes to the surface and is damaged, the radiation level of the subsurface buoy must be determined through the use of the radiological equipment on board (see Annex C). Casualties to the subsurface buoy which create an increase in the radiation level of the RTG above 10 mr/hr at the skin of the buoy and casualties which result in the loss of accountability control of the RTG's are treated as radiological accidents. When a radiological accident occurs, the provisions of OPNAV Instruction 3040.5 must be implemented.

(2) Procedure: The courses of action indicated in Tables II-2 and II-3 provide two notification procedures to be used in the event of a major SEA SPIDER

moor failure. These are:

(a) Notification procedure when RTG's are maintained UNDER CONTROL. (This condition can develop into the second of the two procedures in the case where the RTG's are UNDER CONTROL but an indication of increased radioactivity, resulting from damage, creates a radiological accident. See Table II-2)

(b) Notification procedures for a radiological accident, when RTG's are NOT UNDER CONTROL.

(3) Definitions: The definitions of accountability control used in Table II-2 are as follows:

(a) UNDER CONTROL - The physical location of the subsurface buoy RTG's is known.

(b) NOT UNDER CONTROL - The physical location of the subsurface buoy and RTG's is not known and actions initiated to regain knowledge of its location are not successful within forty eight hours.

(4) Responsibility: The SSOB on the monitoring ship will notify the OCE of any casualty to the moor or to the subsurface buoy immediately by means of a casualty report. The SSOB must state whether or not the RTG (subsurface buoy) is under control or not and whether or not a radiological accident has occurred. Based upon information received from the SSOB the OCE will follow the appropriate notification procedure given in Table II-3 and implement the OPNAV Instruction 3040.5, if appropriate. If a radiological accident has occurred, action required by OPNAV Instruction 3040.5 will be initiated by the Immediate Action Commander, COMASWFORPAC, and the Primary Action Commander, CINCPACFLT.

F. INTRUSIONS OF OPERATION SITE

1. Since SEA SPIDER is located in international waters, the possibility of intentional or inadvertent intrusion, both foreign and domestic, exists during all phases of the experiment. In the event of intrusion, the OCE shall be provided the following information immediately in order that appropriate early action may be taken by COMASWFORPAC:

Table II-2
Courses of Action for Radiological Accident (U)

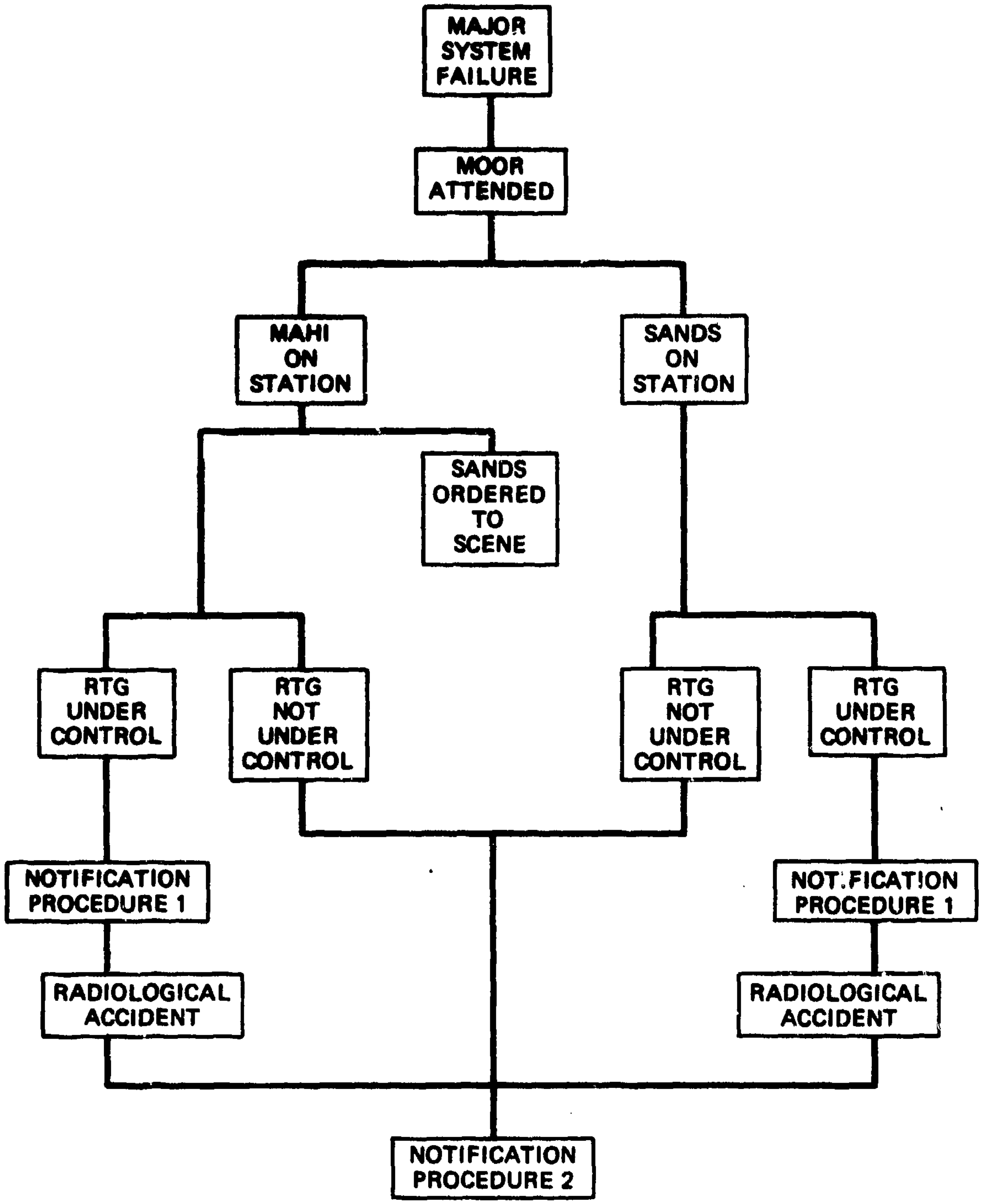
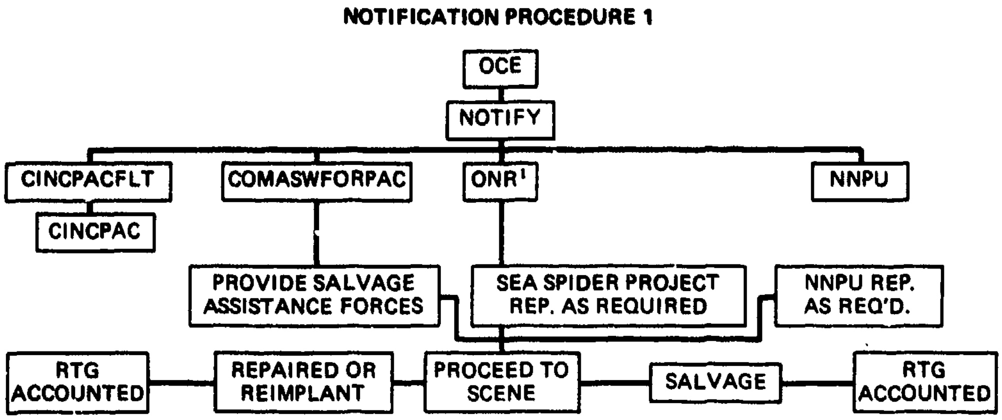
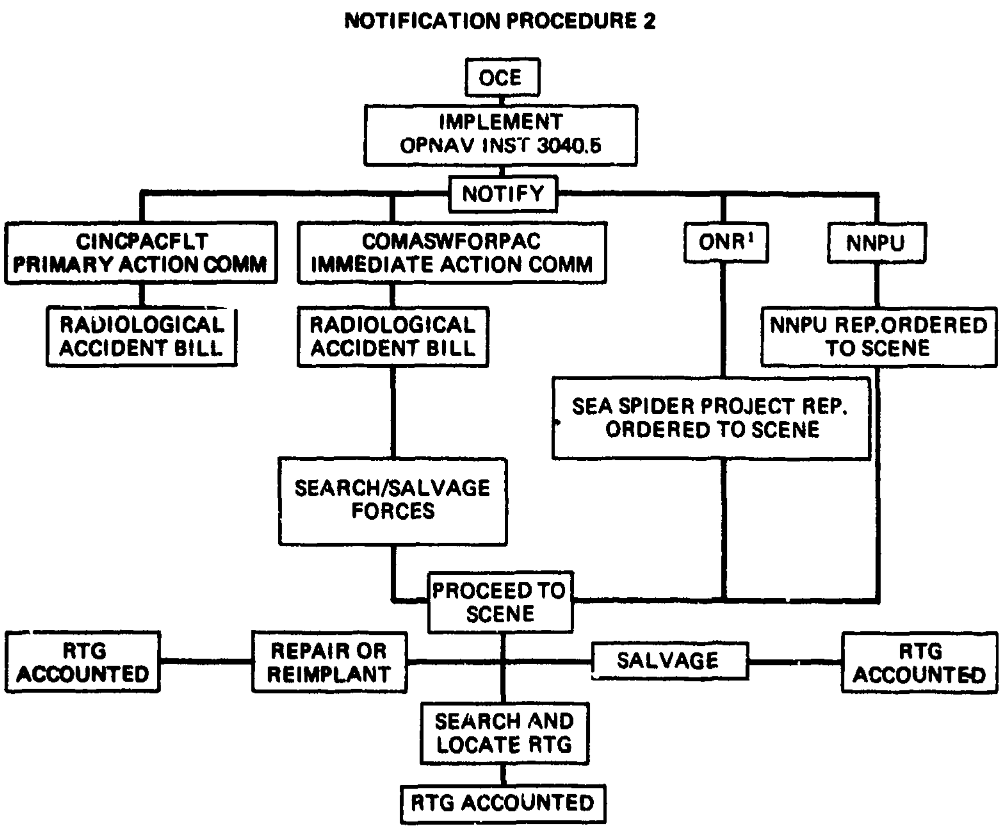


Table II-3
Notification Procedures (U)





a. Type of intruder and nationality.

b. Apparent intentions/activity (trawling, fishing, etc.).

c. Short narrative including estimated closest point of approach to SEA SPIDER.

2. The brevity code words provided in the communications annex (Annex H) shall be used on voice radio nets when providing information about intruders.

ANNEX A

SITE SURVEY AND SEA SPIDER INSTALLATION SUPPORT

1. General

This Annex contains the following:

a. Introduction
b. USL Responsibilities
c. USL Supplied Materiel
d. Signal to Noise Considerations - Spreading Losses
SEA SPIDER Projector
Signals
Ambient Noise
Ships Noise
USL 400 Hz Projector
SEA SPIDER Pinger
e. Acoustic Paths
f. Preliminary Survey
g. Acoustic Locating of Hydrophone - Height off Bottom
Azimuth
Range
h. Navigation
i. Communication

2. Introduction

The Underwater Sound Laboratory will be concerned with two phases of the Pacific SEA SPIDER installation:

a. A preliminary bathymetric and environmental survey of the intended location prior to the installation.

b. Participation in the actual installation.

3. Major USL Responsibilities

The major USL responsibilities in connection with the SEA SPIDER installation include:

a. The preliminary bathymetric and environmental site survey and on-site selection.

b. Navigation - Providing navigation receivers and personnel to operate. USL personnel will maintain geodetic position information of SANDS and maintain radar positions

relative to SANDS of RIGBUILDER and critical buoys and markers. USL will provide information to SANDS bridge for station keeping purposes and will supply updated radar position information on RIGBUILDER and buoys to the RIGBUILDER.

c. Communications - USL will supply all communications equipment (transceivers and antennas) above normal ship's communication equipment necessary to the SEA SPIDER installation. USL will supply operators as required for the SSB HF equipment on SANDS and for the Johnson Messenger Master located on SANDS for passing navigational and SEA SPIDER anchor locational information.

d. Acoustic Positioning - USL will determine by acoustic means, when necessary, the height of the anchor or the lowest hydrophone off the ocean bottom during each lowering. During installation of the second leg, USL will also supply acoustic ranges to the first leg. During installation of the third leg, USL will determine anchor height off bottom, the azimuthal position of the third leg deep projector relative to the two previously installed legs, and will provide acoustic range information between the third leg and the first two legs installed. This information will be passed to the RIGBUILDER on request at intervals of 5 minutes or less.

e. For the sake of clarity, a brief and very general summary of SANDS employment prior to and during the installation, is given below. The leg designations for SEA SPIDER as used below are: NE (Northeast); NW (Northwest); and S (South) legs.

(1) SANDS conduct preliminary environmental and bathymetric site survey, locating carefully the three anchor positions and obtaining accurate depths of these positions.

(2) At Hawaii, brief installation personnel on survey results.

(3) SANDS return to installation site early; recheck surface currents, recheck depths at three anchor positions prior to arrival of RIGBUILDER.

(4) SANDS take and hold station 7000 feet from SEA SPIDER center. RIGBUILDER will make close approach to SANDS and drop free-falling mooring system.

(8) SANDS will make acoustic checks on the operation of all legs, and will then stand in close to the SEA SPIDER subsurface buoy at the installation center. SANDS will remain in this area with decompression chamber during subsequent diving operations concerned with the permanent electrical hook-up.

(9) SANDS make a final check on the operation of all units following permanent electrical hook-up.

4. USL Supplied Material

In connection with these tasks, it will be the responsibility of USL to provide the following critical facilities and material:

M-1 Rifles and Cartridges - To both SANDS and RIGBUILDER.

Seal Charges (Firecrackers) - To both ships; backup to the M-1

Water Current Profiler - For 18,000 foot depth, to SANDS only with recording equipment for survey.

Velocimeter - For 18,000 foot depth, SANDS only, with recording equipment for survey.

Fathometers and Recorders - SANDS only; 3 permanent UQN transducers; 1 temporary UQN transducer; 1 3.5 kc transducer array; 1 deep towed 12 kc fathometer; 2 Giffts Recorders; 1 PGR Recorder

Friden Calculator - For SANDS
Coring devices - For SANDS, 6 Boomerang Corers
Work Boat - Boston Whaler
Surface Current Float with Drogue and Radar Reflector
Acoustic Source - Suspended, shallow depths, 400 Hz, to SANDS. Backup source to SEA SPIDER projector.

Hi-Power Driver and Pulsing Controls - To SANDS, for use with 400 Hz projector.

(5) SANDS take station and hold position at a point 3000 feet beyond the NE leg anchor position along a line from installation center through the NE leg anchor position.

RIGBUILDER will lay cable from free-fall mooring point while SANDS provides position of RIGBUILDER in SEA SPIDER coordinates based on radar range and bearing information from SANDS. (SANDS will check anchor height off bottom with M-1 when near bottom - not required other than for SANDS practice). RIGBUILDER buoy off the NE anchor crown line with radar reflector and radar transponder. SANDS remain near the NE anchor buoy for 6 hours to monitor movement of buoy and establish watch circle on surface. Make acoustic check of all units.

(6) SANDS move to the NW leg and hold station 3000 feet off the NW leg anchor position.

RIGBUILDER start laying cable from subsurface buoy to the NW leg.

SANDS take radar ranges and bearings on RIGBUILDER and provide position of RIGBUILDER in SEA SPIDER coordinates via radio circuit. SANDS monitors and plots buoy positions and times. SANDS obtains and transmits via radio acoustically determined ranges between the NW and NE legs. (Again SANDS make M-1 checks of anchor height off bottom although not required). After anchor is down and crown line buoyed off, SANDS again remains in area and determines behavior of buoy, and acoustically checks all units.

(7) On the S leg, SANDS is to take position directly over anchor position, rather than beyond it. SANDS will again provide radar positions (in SEA SPIDER coordinates) of the RIGBUILDER and the previously installed buoys while the cable is laid and the anchor lowered.

During the anchor lowering, SANDS must in this case provide anchor height off the bottom using the 12 kc free running pinger attached to the anchor. At the same time, SANDS will provide relative azimuth information and range information acoustically obtained by use of the 1000 Hz projector on the S leg in conjunction with hydrophones attached to the NE and NW legs.

Filters - To SANDS: Two 1/3 octave filters centered at 1000 Hz; Two Burnell 30% filters centered at 400 Hz

Navigational Gear - To SANDS: One Satellite Receiver; Two Omega Receivers; Transparent Mercator Charts with Omega Lines

Weather Mapper - To SANDS

Personnel Accommodation Van - To SANDS, for 8 persons

Communications Equipment - To both ships: Two SSB H.F. Transceivers 1 for each ship; for long range communication only.

Two FM Mobile Transceivers 1 for each bridge, 36.3 mc and 35 watts

"Johnson Messengers" Portable transceivers - 2 Masters, 6 handheld, 27.55 MC

In addition, USL will attempt to provide a satisfactory teletype equipment for use on SANDS in connection with the HF Telemetry.

There will, of course, be other items to be supplied by USL which will be determined by the operational details.

5. Signal/Noise Considerations

a. Nominal Propagation Losses

The acoustic measurements to be performed during the SEA SPIDER implantment will involve acoustic ranges between 6000 yards (18,000 foot water depth) and 11,700 yards. The corresponding acoustic spreading losses (Fig. 1) at these frequencies will range from 76 db to 82 db.

b. SEA SPIDER Projector

If the SEA SPIDER ceramic ring projector at 1 kHz is taken to have a source level of +86 db//1 microbar

at 1 yard (for an 80 watt input), then received levels of +10 db//1 microbar to +4 db//1 microbar are to be expected.

The projector has been described as having a 200 Hz bandwidth which would mean a pulse rise time of about 10 milliseconds. A 12-15 millisecond pulse would then achieve steady state. This suggests that any filter used in conjunction with the receiving system should have a similar bandwidth; a 1/3 octave filter centered at 1000 Hz would probably be suitable and would have a bandwidth of approximately 230 Hz.

c. Ambient Noise

The maximum broadband ambient noise level anticipated during operating conditions should be about +2 db//1 microbar, based on the expectation of operating in sea states of 2-1/2 or less with corresponding wind speeds of 15 knots or less. This would, with the SEA SPIDER Projector, permit a received signal to noise ratio, without filtering, at the worst condition of about 2 db - which is not sufficient. With a 1/3 octave filter centered at 1000 Hz, the ambient spectrum level (See Fig. 2) would be -33 db//1 microbar/Hz +10 Log 230 Hz; approximately -9 db//1 microbar. This would allow received signal to noise ratios of 13 db with the SEA SPIDER Projector in the worst situation.

d. Ships Noise

From Fig. 3, the minimum expected broadband ship's noise level (at an equivalent 1 yard distance) for one ship, will be on the order of +56 db//1 microbar and for the two ships +59 db//1 microbar. This would result in broadband levels at the receiving hydrophone of -17 db//1 microbar to -23 db//1 microbar. Maximum broadband source levels, pessimistically could be on the order of +87 and +90 db// microbar for one and two ships resulting in broadband received ships noise levels of +8 to +14 db//1 microbar. These pessimistic higher levels indicate again the desirability of filtering in the receiving system.

The maximum source spectrum level expected for 1 ship at 1.0 kHz is +39 db//1 microbar/Hz and for two ships would be +42 db//1 microbar/Hz and received band levels in a 1/3 octave band would be 24 db higher, or -10 to -14 db// microbar/Hz. Expected signal to noise ratios under the

worst conditions with the SEA SPIDER Projector, should be on the order of 14 db.

It appears that with a 1/3 octave filter centered at 1.0 kHz, the SEA SPIDER ceramic ring projector should be received at the deepest hydrophone on the other two legs with a signal to noise ratio of at least 13 to 14 db under all conditions.

e. USL Source

A USL suspended source will be provided as a backup to the SEA SPIDER source and will permit transmission from SANDS to receivers on the three legs, if required. This source will be a Honeywell HX-90 400 Hz bender bar driven by a 5 kw CML amplifier. The source level expected is +92 db//1 microbar at 1 yard.

This USL source will provide levels at the receiver of +10 to +16 db//1 microbar. This again would be unsatisfactory against the broadband noise levels expected, and some filtering is required. The Burnell 30% filters centered at 400 Hz would have a bandwidth of 120 Hz and are probably adequate and are readily available.

The maximum ambient noise spectrum level expected at 400 Hz should be -30 db//1 microbar. With a bandwidth correction of 21 db, the maximum band level ambient noise expected is -6 db//1 microbar.

The maximum ship's noise spectrum source level at an equivalent 1 yard distance expected at 400 Hz is +50 db//1 microbar. This would result in ship's noise spectrum levels at the receiver of -26 to -32 db//1 microbar. Band levels expected at the receiver would be -5 to -11 db.

It appears then that with the USL projector, signal to noise ratios of at least 15 db can be expected.

f. S Leg Anchor Pinger

A pinger attached above the anchor on the S leg will probably be used to determine height of that anchor off the bottom during installation of the third leg. The pinger is described below.

Frequency - 12 kHz

S997' ' 0. 0

Pulse length - 0.3 milliseconds (Equivalent to 3 kHz bandwidth)
Pulse Interval - 1.0 seconds
Output Level (Downward) - +108 db//1 microbar at 1 meter
Output Level (Upward) - +83 db//1 microbar at 1 meter
Location - 23 feet off bottom when cable installed at 45° angle

This pinger would be used only in a vertical geometry, with the anchor near the bottom, so that only those path lengths of 6000 yards or so, are pertinent. Maximum spreading losses will then be on the order of 76 db. Attenuation of this frequency becomes significant and will be on the order of 9 db. Bottom reflection loss is estimated to be 18 db at 12 kHz normal incidence in this area. This results in a total transmission loss via the bottom, of approximately 103 db. That is, signal levels of +5 db//1 microbar will be received at the surface.

The pinger has a source level approximately 4 db less than the source level of the shipborne standard fathometer but, being near the bottom, the pinger signals will suffer transmission losses which are 15 db less than those suffered by a shipborne fathometer signal. The expected received signal-to-noise ratio at the surface, for pinger generated signals, is approximately 9 db higher than for fathometer generated signals and should be more than adequate.

Pinger signals will be recorded on the Gifft Receiver on the 10 fathom scale for maximum resolution. Height of the pinger off the bottom will be equal to one-half the difference between the direct and reflected signals, corrected for near bottom velocities. Correction then for the height of the pinger above the anchor must be made to estimate anchor height off the bottom.

6. Acoustic Paths

Where acoustic positioning/location methods are to be used during the SEA SPIDER Installation, the existence of critical acoustic paths must be preestablished.

The path of major concern here is the path between the deep SEA SPIDER projector on one leg (i.e., when projector

is on or near the bottom) and the deep (lowest) hydrophone on one of the previously installed legs.

The geometry for the above situation is indicated diagrammatically in Figure 4. The source position is taken as the installed position and the positions of four receiving hydrophones on another previously installed leg are shown.

The velocity profile is critical in this situation. Figure 5 is a velocity profile taken at the installation site during the same month one year earlier (August 1968). The lower portion of the profile is quite constant from year to year. It is reported that the several velocity profiles measured in August 1968 overlay each other within the drawing error.

Ray paths have been computed for the situation diagrammed in Figure 4. The ray paths from the SEA SPIDER source to hydrophones at 3,000, 10,500, 16,000 and 17,538 feet are shown in Figure 6.

Other program outputs for this computation are given below:

SOURCE DEPTH (ft)	RECEIVER DEPTH IN FEET	HORIZONTAL RANGE IN YDS	DEPARTURE ANGLE REFERENCED TO HORIZONTAL IN DEGREES	TRAVEL TIME IN SECONDS	SPREADING LOSS IN db
600	17,538	10,127	3.14° Downgoing	5.98	80.1
600	16,000	9,685	.041° Upgoing	5.74	79.7
600	10,500	8,179	13.48° Upgoing	5.09	78.5
600	3,000	6,402	35.23° Upgoing	4.86	77.8

In the situation where the source is 600 feet off the bottom and the receiver is 600 feet off the bottom, the ray path will vertex between the two at some lesser distance off the bottom. The nominal vertex depth for the situation examined is 17,954 feet. That is, with a water depth of 18,138 feet, the path approaches to a height off the (flat) bottom of 184 feet midway between source and receiver. This means that no elevation greater than 184 feet can be tolerated at this point.

It should be understood also, that there is some uncertainty in the result, and perhaps 184 feet should not be approached too confidently.

Furthermore, fairly slight changes in the velocity profile will alter this vertex depth somewhat.

An example of the effect of such a change is indicated below, where the velocity profile was altered by amounts which might occur in the real world.

AT WATER DEPTH (Feet)	VELOCITIES Used (ft/sec)	RESULTING VERTEX DEPTH (Feet)
17,580 18,180	5078.75 5089.50	17,980
17,580 18,180	5078.25 5089.0	17,980
17,580 18,180	5079 5089.0	17,950

The change in vertex depth to a change of 0.25 ft/sec at 17,580 is then 30 feet. Such a change might go either way, of course.

The results of the above acoustic path computations are summarized in Figure 6, with the nominal paths shown plotted to scale.

In Figure 7, the most critical case, that for the path from the deep source to the deep receiver is expanded and plotted with a vertical exaggeration of 20:1. It will be seen that the ray path between these source/receiver pairs vertexes 184 feet above a flat bottom.

Based on the bathymetry shown in Figure 11, the expected paths between NW-NE, NW-S, NE-S legs are shown in Figures 8, 9 and 10 respectively. It should also be noted that due to this bathymetry, direct ray paths do not exist between the deep source and deepest hydrophone between the NW and NE legs, and also between the NE and S legs. Also, although a direct ray path does exist between the deep source and deepest hydrophone for the NW and S legs, this ray clears the bottom by only 75 feet.

Despite the absence of direct paths between source and receiver, it is likely that there will be source reception via paths other than the limiting ray which reflect

from appropriate facets of the bottom. Usefulness of these paths is, however, questionable.

7. Preliminary Survey

On reaching the installation site, aboard SANDS, on or about 30 July, USL personnel will initiate a survey of the area. The primary purpose of the survey is to determine whether or not the specified anchor positions are indeed suitable according to the best navigation achievable with Satellite and Omega, and if not, to determine a site as close as possible to the intended site that is satisfactory.

A brief outline of the survey approach intended is given below.

Step 1. Make an acoustic velocity cast at 27°31.60'N and 157°40'W (Point A, Figure 11).

Step 2. To orient the existing bathymetric chart in more accurate geodetic coordinates, SANDS will operate the hullmounted 12 kc fathometer and execute a short rectangular track approximately 50 miles in length, cutting several prominent bottom features. On arriving at the site, SANDS will approach the area heading 270°T from point A, and pass through the installation center to 157°59.3'W, turn and steam along 000°T to 27°37.0'N. At that point SANDS will turn again and steam along 090°T to 157°40'W, SANDS then steam on 180° to 27°31.6'N. The resulting data will be velocity corrected and plotted to the same scale as the existing chart. A fitting of the new data to the old chart should make apparent any significant navigational errors in the earlier chart.

Step 3. Case (a) - (No geographic discrepancy noted above) SANDS immediately run a 15 mile triangular track outlining the installation at existing coordinates with special attention to the anchor sites.

Case (b) - (Significant geographic discrepancies noted) Adjust old bathymetric chart to new coordinates and SANDS run the triangular track as above.

Case (c) - (No observed correlation between new and old data). SANDS again run the preselected triangular track using the coordinates specified, but

with improved navigational data.

Step 4. Make velocity corrections to data and plot bathymetric profile of each of the three sides of the triangular track. Check for bottom prominences and check depths at anchor sites closely.

Step 5. Case (a) - If the bathymetric profiles along the above triangular track appear to be satisfactory, then with the exception of some depth refinement at the anchor sites, the bathymetric survey is complete.

Case (b) - If the results of the triangular track are not satisfactory, then SANDS will initiate a 10 mile by 10 mile bathymetric grid centered approximately on the preselected array center. (Details of grid will be discussed later).

Step 6. When grid track is complete, make velocity correction to final data (Make slope corrections if required. This is not expected however, according to the preliminary data available). Plot the data on a Mercator projection. When complete, select optimum suitable location and anchor points.

Step 7. Return to anchor points and check depths with both hullmounted fathometer and with deep towed 12 kc fathometer at 17,500 feet. It will probably be necessary to execute a loop track crossing at each of the anchor points rather than lying-to with the fathometer suspended.

Step 8. If results of final checks are satisfactory, contact installation leader and communicate results.

Step 9. Make water current determinations.

a. Make surface current determination over a 12-14 hour period using a heavy float with minimum wind surface and provided with a drogue and a radar reflector. Plot positions of float with time over the entire period. Launch float at moor center. Maintain accurate ships position log during entire period.

b. Concurrently, lower current profiles

to near bottom; recording water current speed and direction as a function of depth. Make two such casts in the 12-14 hour period, if possible. Obtain ships motion during the period from Satellite/Omega position log to make corrections to water current data.

Step 10. Return to each of the three anchor sites selected and drop two boomerang corers at each site.

Step 11. Every four hours during the survey period, log observations of wind speed and wave height, and take a bathythermograph record to establish depth of surface layer. Log layer depth only with wind and wave data.

Step 12. Proceed to port rendezvous.

Bathymetric Grid

If a bathymetric grid should be required, it will be a 10 mile x 10 mile square centered approximately on the defined moor center (27°31.6'N, 157°44.04'W). Lane spacings will be 1/2 mile in each direction. Total steaming will be 420 miles, or 42 hours at 10 knots. The hull mounted 12 kc fathometer will be used. In the event of poor bottom returns, the speed may have to be reduced.

The grid lanes will be north-south and east-west in direction.

North Boundary - 27° 36.6'N
South Boundary - 27° 26.6'N
East Boundary - 157° 38'W
West Boundary - 157° 50'W

SANDS will start grid at northeast corner 27° 36.6'N, 157° 38'W and steam south. At the southern boundary SANDS will move 1 lane (1/2 mile) west and steam to the northern boundary and will continue with all of the north-south runs. At the end of the 21st run SANDS will be at 27° 26.6'N, 157° 50'W. SANDS will then head east and execute all of the east-west runs, terminating finally at the start point.

Velocity corrections and data plotting will be performed

during the grid run. All data will be transcribed to a Mercator projection.

It is expected that eight men will be required for this task, working two alternating 4-hour shifts. That is, there will be required 4 men on each shift.

1 man annotating fathometer trace, reading and logging time and raw depth data.

2 man team logging and plotting (from Omega charts) position and time.

1 man making velocity corrections and plotting depth points on the track.

Deep Towed Fathometer

The deep towed fathometer to be used in the final depth checks at the anchor sites is a standard 12 kHz fathometer head, downward looking, lowered from the SANDS on 20,000 feet of cable. Depth of the transducer is obtained from a pressure sensor in the body which is quoted as being accurate to 0.25% of full scale (20,000 feet). That is, this system should be good to approximately 50 feet.

8. ACOUSTIC POSITIONING OF HYDROPHONE

a. (1) It will be essential that the height of the anchor off the bottom be acoustically determined during the installation of the third leg, and desirable during the installation of the first and second legs.

It is thought that during the installation of the first two legs, the anchor lowering (crown line) will be practically vertical and that cable distance markings on the lowering crown line will probably provide adequate altitude information.

In the case of the third leg, the installing ship will be well beyond the anchor point and exerting a horizontal pull on the third leg during anchor lowering so that cable distance markings will not suffice.

There will be at least four possible ways of using bottom reflected signals in determining the anchor

altitude during installation of the third leg. These are listed in order of preference:

1. SEA SPIDER anchor pinger (For third leg only).

2. SEA SPIDER projector

3. M-1 rifle shots from SANDS

4. USL suspended projector (from SANDS)

(2) Height Determination with Sea Spider Projector

It appears that the simplest way of determining the height of the anchor for the first and second legs is to pulse the SEA SPIDER Projector (1 kHz) and to record the bottom reflected pulse as received at the deepest hydrophone on the same leg.

It is thought that a high speed optical recorder (e.g., Visicorder) would be the easiest means of recording and directly reading the data. This recorder should be backed up by a long persistence oscilloscope (Memoscope) for parallel viewing.

The recorder could reasonably be operated at 40 inches/second and the tapes could be read to .05 inches. At 40 ips this would give an easily achievable record resolution of 1.25 milliseconds - equivalent to about 6 feet. Actually, since the 200 Hz projector band width will impose more severe resolution limitations, it might be more reasonable to operate the recorder at 20 ips and accept a 2.5 millisecond 12 foot resolution.

Recorder time lines at 10 or 20 millisecond intervals would be reasonable - approximately every 50 or 100 feet of acoustic path length. The Gerber scale will be useful in interpolating between time lines here.

Near-bottom (18,138 feet) acoustic velocities of 1550m/sec (5089 feet per second) are expected, and a time-to-distance conversion chart should be prepared at USL, prior to the operation, based on this velocity which will also take into account the vertical separations

due to positioning along the cable between projector, receiver, and anchor in the near-bottom configuration.

The actual transmit pulse, or time of transmit pulse, must appear on the oscillographic record with the received pulse. (Note: This transmit timing pulse must be made available by IEC or AC DRL from the telemetry stack). The observer will simply count the time divisions between transmit time and receive time, interpolate for precise start and stop times, and obtain the estimated depth off bottom from the conversion chart. This reading time should not require more than 90 seconds, and the information will then be passed directly to the Supply Ship by the observer.

Obviously, at the time that the anchor is near the surface, the paper speed of 20 ips is not required. From heights of 18,000 feet off the bottom, down to 3,000 feet off the bottom, a paper speed of approximately 5 ips would be more reasonable which would result in record lengths of 3 or 4 feet down to lengths of 6 or 7 inches. Resolutions here would be poorer, on the order of 50 feet, but adequate while at these heights off the bottom. At a height of 3,000 feet off the bottom, it is recommended that the paper speed be increased to 20 ips for the higher resolution.

The start and stop times of the paper recorder should be keyed to the pulsing of the SEA SPIDER Projector through auxiliary USL supplied preset counters. This is to insure that the recorder paper drive is up to speed at the time the pulse is transmitted (otherwise the time lines on the record will not be reliable) and that the drive is secured at the proper time to insure reception of the bottom reflected signal at the hydrophone without generating excessive paper lengths.

A third backup readout system might be considered which could again be run in parallel with the oscillographic recorder and the Memoscope. This would be simply a counter started by the transmitted pulse and stopped by the received pulse. This would be extremely convenient if operable - the danger being that such a system is subject to transient noise bursts and proper thresholding of the received pulse under the conditions of the operation might well be impossible.

If a bottom reflection loss for a 1.0 kHz signal at vertical incidence of 15 db is assumed (based on MGS data taken in surrounding areas), then the total propagation loss from the projector to receiver, while at the surface, would be +97 db//1 microbar. At the same time, ships noise would be high near the surface, on the order of +37 db//1 microbar broadband at a ship's range of 1,000 feet. Spectrum noise levels at 1.0 kHz would be -21 db//1 microbar and the 1/3 octave band levels would be about +3 db//1 microbar. The received signal level would be approximately -11 db//1 microbar and would not be detected in that filter band. However, at a depth of 3,000 feet, the signal to noise ratio will be on the order of +5 db. This signal to noise ratio will be adequate and will be increasingly improved at greater depths.

Note that the reported hydrophone/projector separation will be on the order of five feet and will be negligible for this purpose. No correction for this separation will be recorded.

(3) Height Determination With M-1 Rifle

A secondary method of determining the height of the lowest hydrophone (hence anchor) off the bottom, for the first and second legs, would make use of the M-1 rifle fired from the boat deck of the SANDS. The impulsive signal generated by the bullet impacting the surface of the water (nominally at an angle of 45°) has a broadband level of approximately +127 db//1 microbar and will be detectable above the noise.

A microphone can be suspended on the rail near the point of firing, and patched to one channel of the Visicorder (and/or Memoscope and/or the start input of a counter). A speaker should be used in parallel with this channel so that the Visicorder can be started 1 second before the M-1 is fired. This 1 second warning can be given by the man firing the rifle, by voice or by a coded rapping of the microphone. A speaker on the hydrophone output is normally used as a cue to turn off the recorder.

One-half the total time difference on the Visicorder record between receipt of the first arrival (direct signal) and the second arrival (first bottom bounce) is translated directly into distance off the bottom.

This method could, if necessary, be used when the anchor is at depths less than 3,000 feet, and could be used during the installation of legs 1 and 2 with a minimum of personnel required as long as the lowest hydrophone output can be monitored.

It should be noted that the M-1 impact signal has a dipole pattern which falls off sharply at ranges in excess of 2 or 3 miles. It is best used in near vertical geometries.

(4) Height Determination With Anchor Pinger

The most desirable means of determining height off the bottom, in the case of the S leg, would be by use of the 12 kc pinger on the anchor.

One possible difficulty here is that where fathometer heads on the ship are used as receiving hydrophones, the beam widths can become critical. The pattern is 3 db down 15° off vertical and 10 db down 25° off vertical and drops very rapidly beyond that point.

At 25° (-10 db point) limiting horizontal separations for 3 depths are given below:

DEPTH	HORIZONTAL SEPARATION
3,000 feet	1,400 feet
10,000 feet	4,700 feet
18,000 feet	8,500 feet

It would be difficult to state at this time, that SANDS will always be within those horizontal ranges of the hydrophone during the installation of the third leg. If an omnidirectional suspended hydrophone is used in place of the fathometer, then noise may become a serious problem and it is questionable whether the pinger will be detectable. (In the event that serious difficulties are encountered in use of the pinger, then the SEA SPIDER projector or the M-1 rifle will be used.)

Recording of pinger signals will be on the Giffts recorder, where again, one-half the difference in depth between the direct signal and the bottom reflected signal will give the height off the bottom directly. (To be corrected by actual near bottom acoustic velocities and by the small height of the pinger above the anchor bottom.)

(5) Finally, the 400 Hz USL projector suspended from SANDS could be used in the same manner that the M-1 rifle shots might be used.

All equipment to use the projector for this purpose will be aboard. However, this method would require use of additional electronics and require added personnel which situation will be avoided, if possible.

b. Relative Azimuth Determination

Since it is important that the three legs of the SEA SPIDER be installed with equal angular separation, then the azimuthal position of the third leg relative to the two installed legs must be determined during installation of that leg, and the information available to be passed when required, to the Supply Boat.

This information must be available while handling the third leg, including the period prior to lowering, so that much of the time the projector and hydrophone on that leg will be near the surface, and the cable under tension. In this situation, the hydrophone will most probably not be useable due to noise generated by SANDS and the RIGBUILDER, and more importantly, due to the noise from the cable under tension.

It is felt that this noise situation dictates that the projector be used on the S leg transmitting to the receiving hydrophone on the NE and NW legs, and will probably not permit the converse arrangement

It is further felt that the use of the projector on the S leg must be the primary source for determination of azimuth and ranges during the installation of that leg. The use of any source from SANDS must be considered secondary since the uncertainty in the position of the anchor (and hydrophone) relative to SANDS will always be large. In the event of a failure of the projector on the S leg, use of signals from SANDS would have to be used, but placement accuracy will, in that case, be poor.

It is also thought that there are significant advantages to using the hydrophone on the NE and NW legs located at 10,000 feet and 10,500 feet as primary receivers during this phase of the operation, rather than the deep hydrophones:

(1) Higher probability of satisfactory transmission paths.

(2) Continual and simultaneous use of both hydrophones.

(3) Permits direct comparison of arrival times for each projector transmission.

(4) More rapid data acquisition and reading.

(5) Certain separation of direct and bottom reflected transmission paths.

There will, of course, be a path length difference due to the 500 feet difference in depth, which is equivalent to about 41 milliseconds. A correction for this small difference can be easily applied at the time of each reading. That is, the computed travel time to the 10,500 foot hydrophone is 5.089 seconds and to the 10,000 foot hydrophone is 5.048 seconds. Basically, the same recording system would be used here that was described earlier for the height determination with the SEA SPIDER projector. Each projector pulse would provide azimuth information as well as height information (and incidentally, range information).

Primary data acquisition would again be on the optical recorder. The two hydrophone output signals provided by the IEC-AC/DRL telemetering equipment would be patched to two adjacent recorder channels for direct arrival time comparison. Reading would be aided by the recorder time lines and the Gerber Scale. The same recorder speeds as a function of depth indicated earlier would be suitable here also.

While one optical recorder will be sufficient, if Memoscope and/or controlled counter backup readout systems are designed for this measurement, as well as for height measurements, separate provision for these should be made.

Prior to embarking, curves of travel time vs range between source and receivers should be prepared at least

for the near bottom situation to speed computations. Similarly, a chart of travel-time difference as a function of relative azimuthal angle for perhaps 3 ranges would be of considerable aid.

Travel times and travel time difference should be logged directly and the conversions to angles and distances logged for communicating to the RIGBUILDER when requested.

c. Range Determination

S leg - As indicated earlier, the determination of range from the S leg to the other two legs will be available from the same measurement performed to obtain the azimuth information. All of the discussion under azimuth determination is pertinent here also.

Total travel times will be read from the S leg projector to the receiving hydrophones on the NE and NW legs and converted to range. Times will be read from the Visicorder trace or from the Memoscope or the counter, whichever is most convenient.

When the S leg is in the proper installed position, the travel times to the deep hydrophone (600 feet off bottom) will be 5.98 seconds. At the same time, the acoustic travel times to the hydrophones located at depths of 10,000 and 10,500 feet will be 5.048 seconds and 5.089 seconds respectively.

In the event that the S leg projector is inoperative, the projectors on the NE and NW legs will be used and the signals received on the deep hydrophone on the S leg.

NW leg - During the installation of the NW leg, there will, of course, be no acoustic determination of azimuth, but there is a need to establish range acoustically.

In this case, use of the upper hydrophones (at 10,000 feet) will not be satisfactory since they will not be in their final positions. Therefore, the projector on the NW leg will be used to transmit to the deep hydrophone on the NE leg. The desired installed travel time again is 5.98 seconds. It will be necessary then in this situation to rely on the reflected signal as the NW leg anchor approaches the bottom (see Fig. 10).

9. Navigation

USL personnel aboard SANDS will be responsible for obtaining all required navigational data and making it available to the RIGBUILDER on request, during the installation.

SANDS will find and keep its own position using as navigational aids a Satellite navigational receiver and two Omega navigational receivers.

Positions of the RIGBUILDER and buoys will be obtained relative to SANDS with radar. The buoys will be fitted with radar transponders to aid in detection.

USL will provide one Satellite receiver with critical spare parts. There will be one factory man or factory trained man aboard. There will be no spare Satellite receiver aboard. USL will supply operators.

USL will supply three Omega receivers. Two will be used in parallel operation and the third is provided as a spare unit, or can be transferred to the RIGBUILDER if required. USL will supply Omega operators aboard SANDS.

The Satellite navigational fixes will be regarded as primary and will normally be interpolated by Omega fixes. In the event of a catastrophic Satellite receiver failure, the Omega will be used as the primary system.

Expected navigational accuracies are:

Satellite:	±100 yards (200 yard diameter circle)
Omega:	Absolute ±0.5 miles
	Relative ±600 feet (400 yard diameter circle)

In case of Satellite failure, the ±600 feet will be achievable with the Omega system as absolute accuracy for perhaps a 15 day period, providing good Satellite fixes have been available for a period of 48 hours prior to its loss.

The two Omega receivers mentioned will be run side by side off a common antenna. One will be operated at 10.2 kHz and the other will be operated at 13.6 kHz. This is to take advantage of the better of the two in terms of propagation conditions.

The Omega navigator provides two of three available difference traces on a paper record; A-C, C-D, and A-D. The C-D and A-D are preferred in the SEA SPIDER area and will be used primarily.

USL personnel will have the published Omega sky wave corrections for the pertinent 4^{o} square. However, improved correction charts will be constructed in the area with the Satellite information. Omega sky wave corrections will be commenced at a range of 200 miles from the site or approach to the site and will continue throughout the survey. Corrections will be resumed at 200 miles from the site on SANDS return to the site immediately prior to installation.

SANDS will also carry a rubidium time standard and will have the capability of performing so-called range-range (circular grid) navigation. This permits use of only two stations and will in some situations provide improved accuracy.

Antennas for both Satellite and Omega navigational systems will be installed on SANDS prior to departure from U.S.

The Satellite receiver and both Omega receivers will be located in the Scientific Chart Room aboard SANDS. Direct radio communication from the Chart Room to the Supply Boat will be available. There will also be a four man navigational team in the Chart Room, another man at the radar on the bridge and a sixth rotating relief available.

The 6 man navigational team is expected to consist of:

1 man on radar on bridge.

1 man plotting radar positions of Supply Boat and buoys on the chart. He supplies this information to the communicator in SEA SPIDER coordinates.

1 factory (trained) man on Satellite navigator.

1 man on Omega - reading and plotting SANDS positions from both Omega and Satellite.

1 man as radio communicator with Supply Boat.

1 man to rotate and relieve personnel during installation. Since each leg installation is expected to take on the order of 8 hours, no second shift should be necessary.

The above procedure implies that Mercator projection transparent charts as work charts must be prepared. These

charts must have the Omega lines traced on them. These charts must further be made dimensionally compatible with the DRL SEA SPIDER chart.

It is also noted that the transponders to be placed on the buoys will require a minor modification to the SANDS radar. It is understood that DRL will perform this modification while SANDS is in Santa Barbara. It is also understood that when receiving the transponder outputs, the radar cannot be used to detect normal targets. (A switch is provided to select either mode of operation.) It would then be desirable if the RIGBUILDER operated a similar transponder topside during the installation operation to avoid the necessity of switching back and forth between modes, since the RIGBUILDER will be consistently tracked as well as the buoys.

10. Communication

As indicated earlier, USL will supply the necessary communications equipment for both ships, and will supply radio operators on SANDS.

The communication equipment provided will consist of:

Two KWM-2 SSB HF Transceivers - 1 for each ship. For long-range communication only between ships or ship to shore.

One 500 Watt Linear Amplifier - For SSB Transceiver aboard RIGBUILDER.

Two FM Mobile Transceivers- 1 for each bridge. 36.3 mc and 35 watts

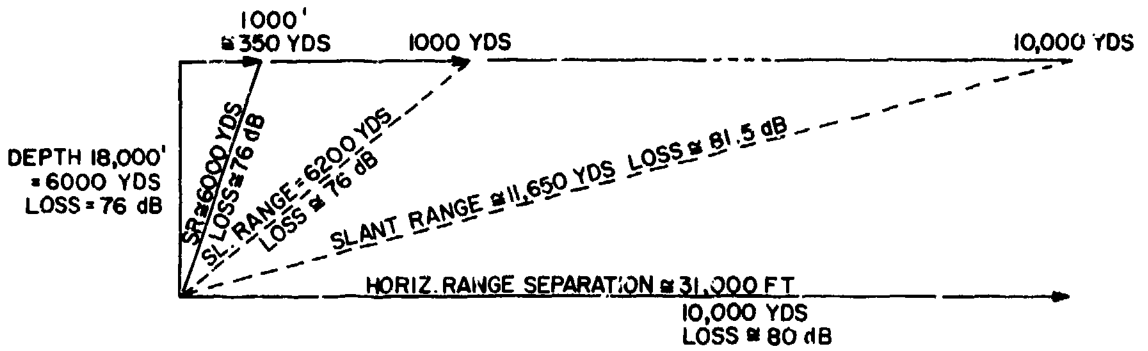
"Johnson Messenger" portable transceivers - 2 Masters; 6 Handheld at 27.55 mc

The final location of each of these units and the number of stations on a frequency must be determined by the installation leader. It is pointed out that the acoustic location information will be passed from the sound laboratory (Dry Lab) on SANDS, a point quite remote from the Scientific Chart Room from whence the navigational data will be passed. These two circuits should presumably be in parallel to a common transceiver available to the installation leader.

If the Johnson Messenger circuit is required for small boat, RIGBUILDER Fantail, etc., then it may be necessary to provide one or two additional FM transceivers.

The portable Johnson units require no fixed antenna. Antennas for the FM mobile units are normally strapped to the rail. Only the SSB will require a fixed antenna. The SSB antenna on SANDS will be installed prior to Santa Barbara. It is recommended that a 25 foot whip antenna be installed on the RIGBUILDER for the SSB Transceiver.

Any required ship to shore SSB communication with AC-DRL will be on 8276.5 or 12147.5 kHz (413.5 kHz will not be useable) on upper sideband. Ship to ship frequencies assigned to PARKA are not yet available.



NOTE THAT ALL EXPECTED LOSSES WHETHER FROM SURFACE TO BOTTOM OR BOTTOMED SOURCE TO BOTTOMED RECEIVER WILL BE BETWEEN 76 AND 81.5 dB.

Fig. A-1 - Diagrammatic ray paths for Sea Spider installation with approximate acoustic signal losses

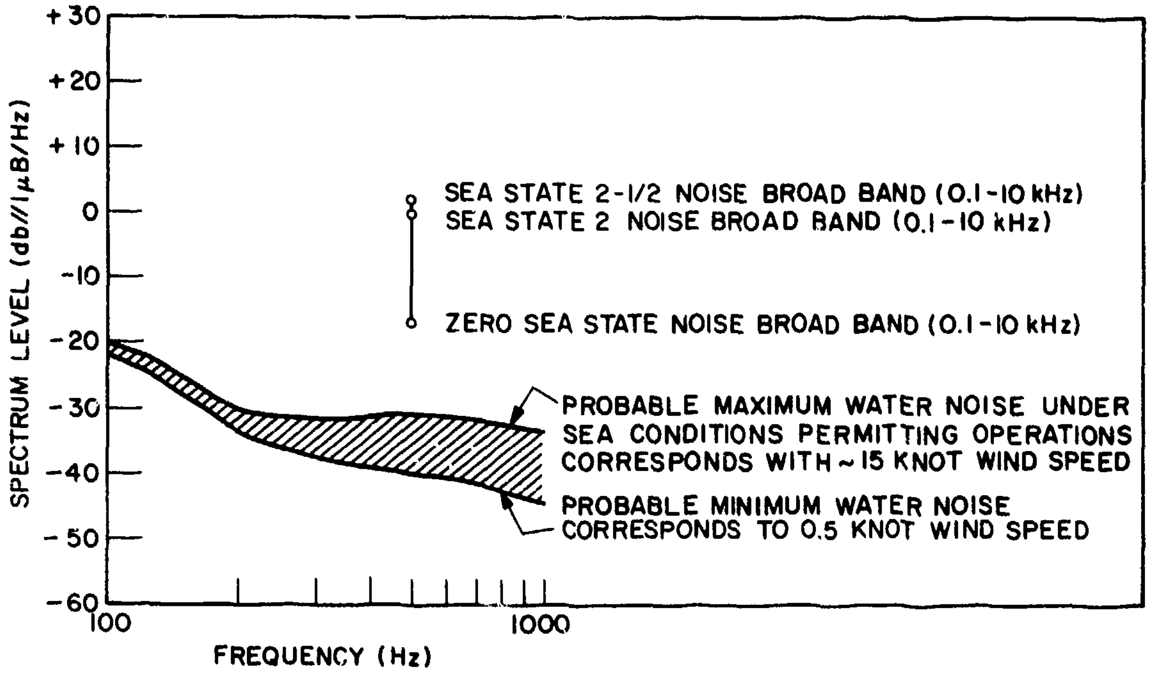


Fig. A-2 - Anticipated ambient (water) noise in operating weather

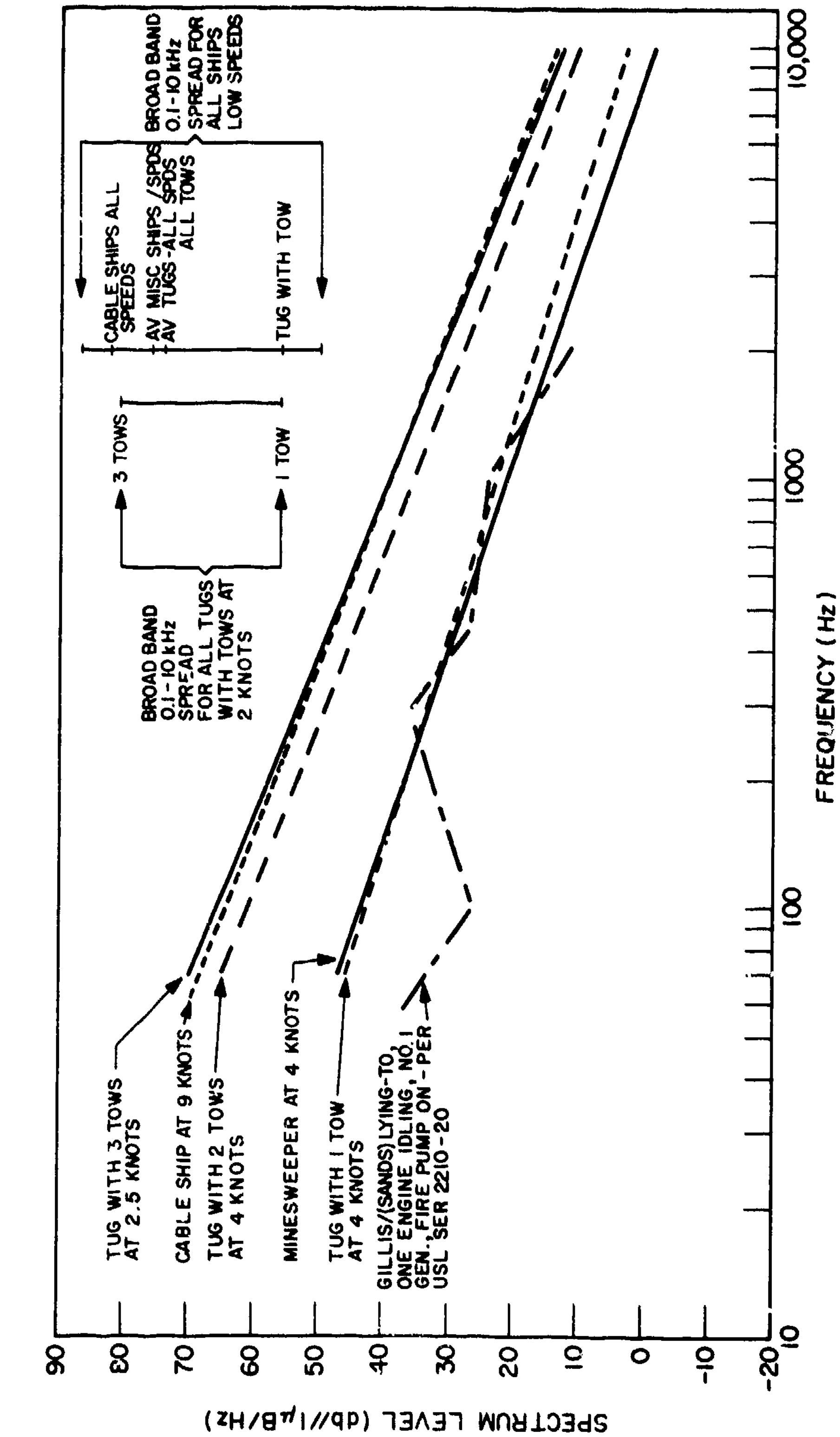


Fig. A-3 - Some ships radiated noise levels extrapolated back to 1 yard

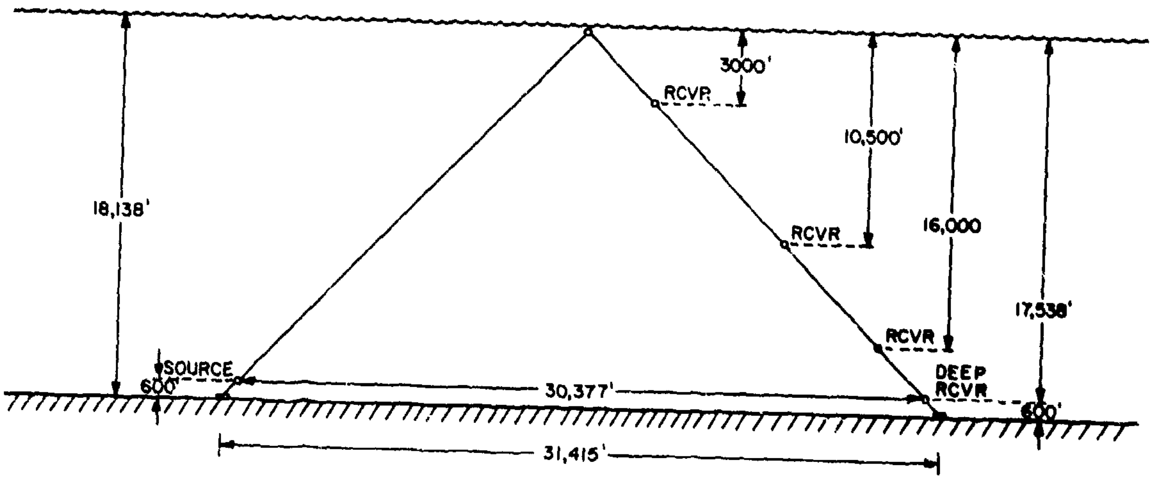


Fig. A-4 - PARKA Sea Spider geometry

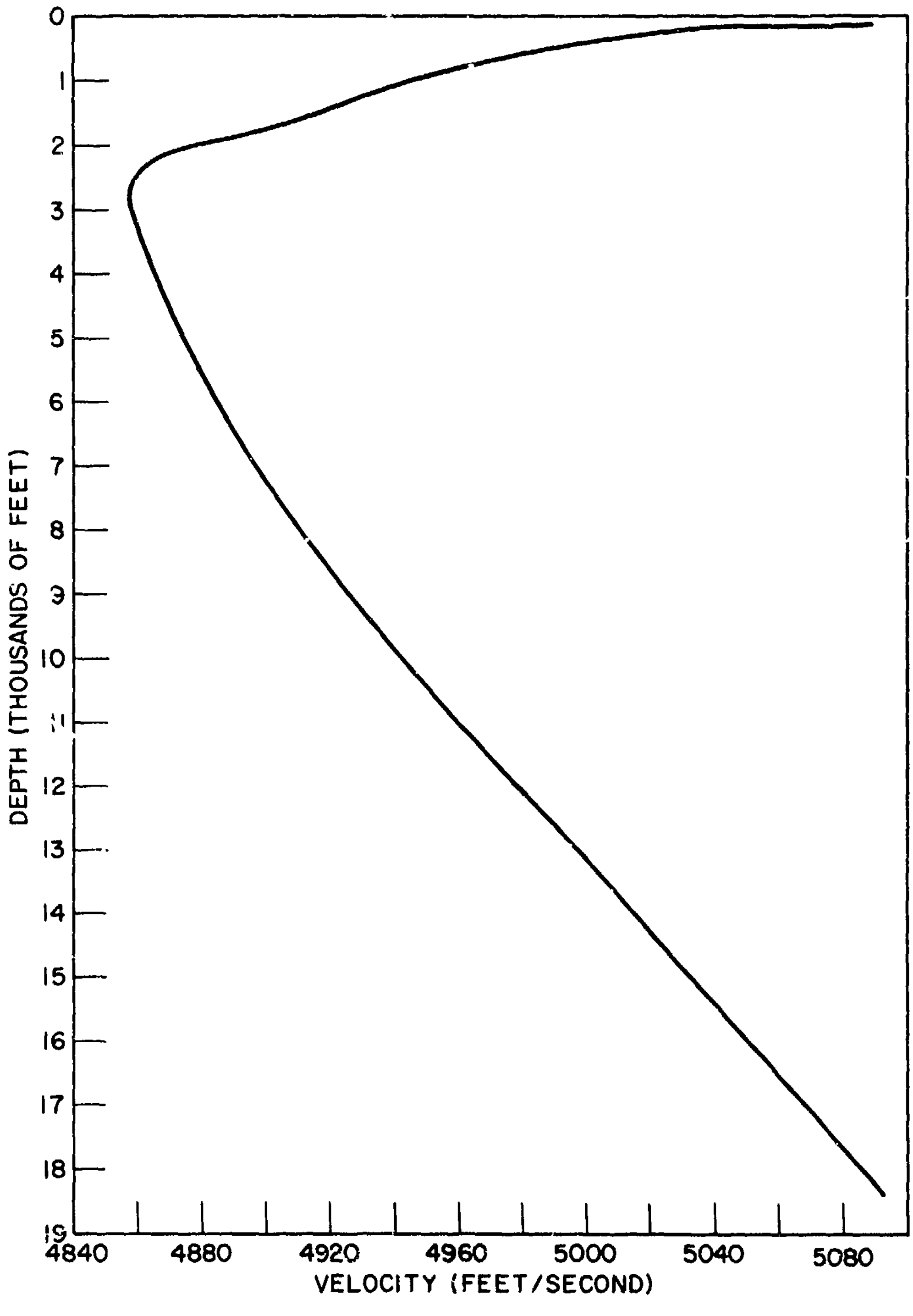


Fig. A-5 - Representative velocity profile Pacific Sea Spider Installation Site (measured August 1968)

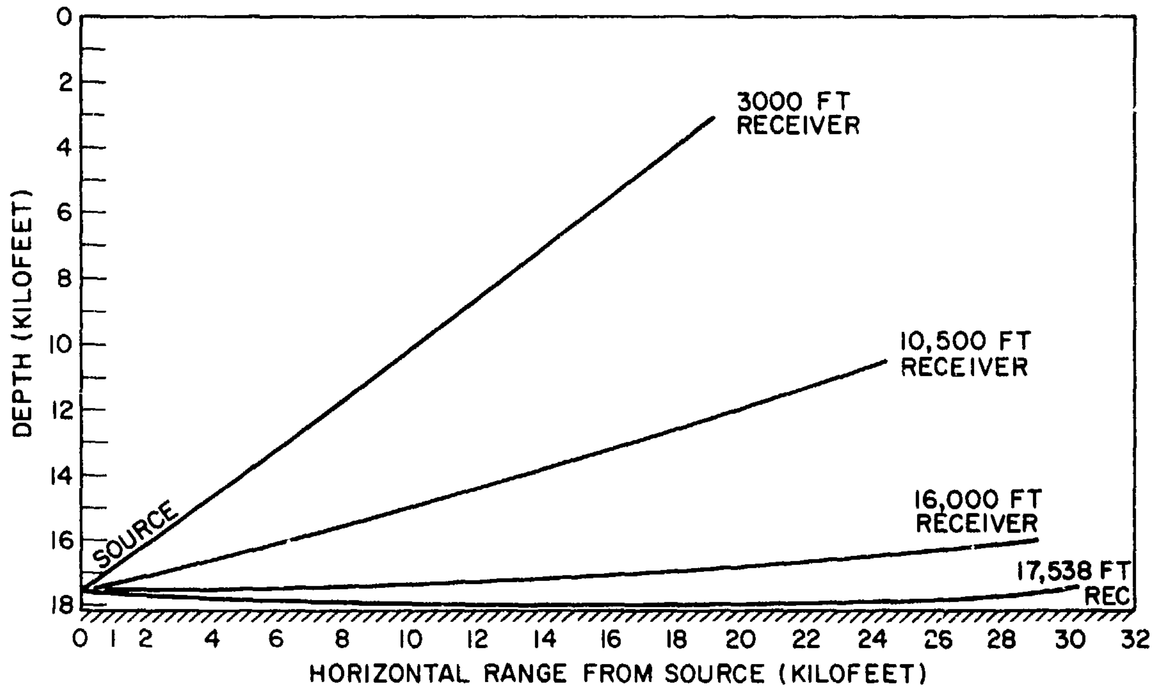


Fig. A-6 - Source to receiver ray paths, source 600 ft off bottom

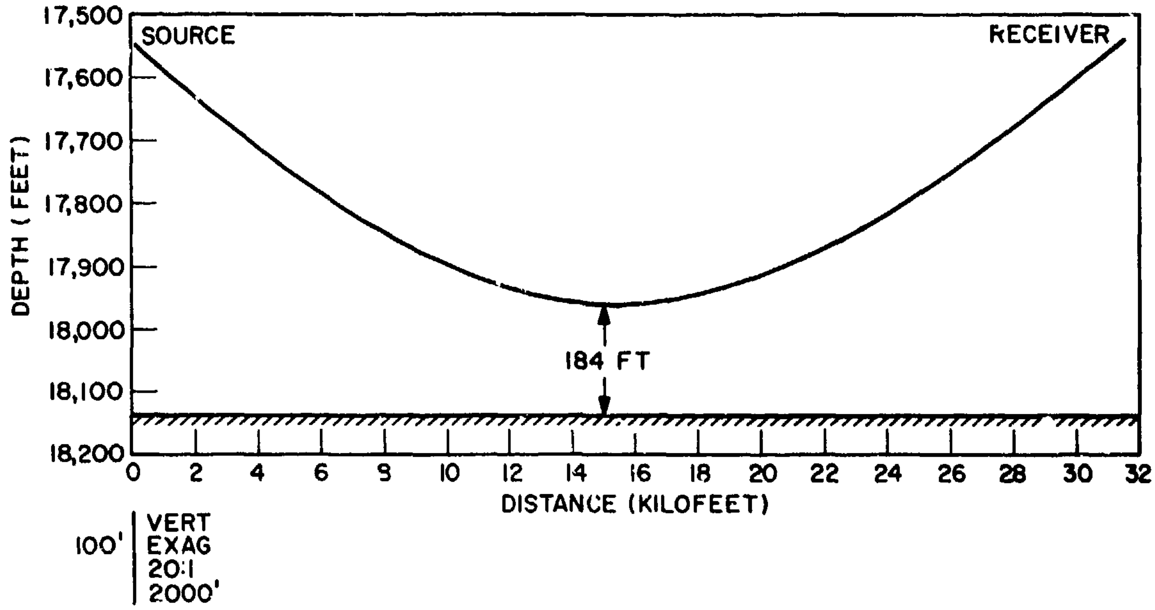


Fig. A-7 - Ray path from deep source to deep receiver, nominal flat bottom at 18,138 feet

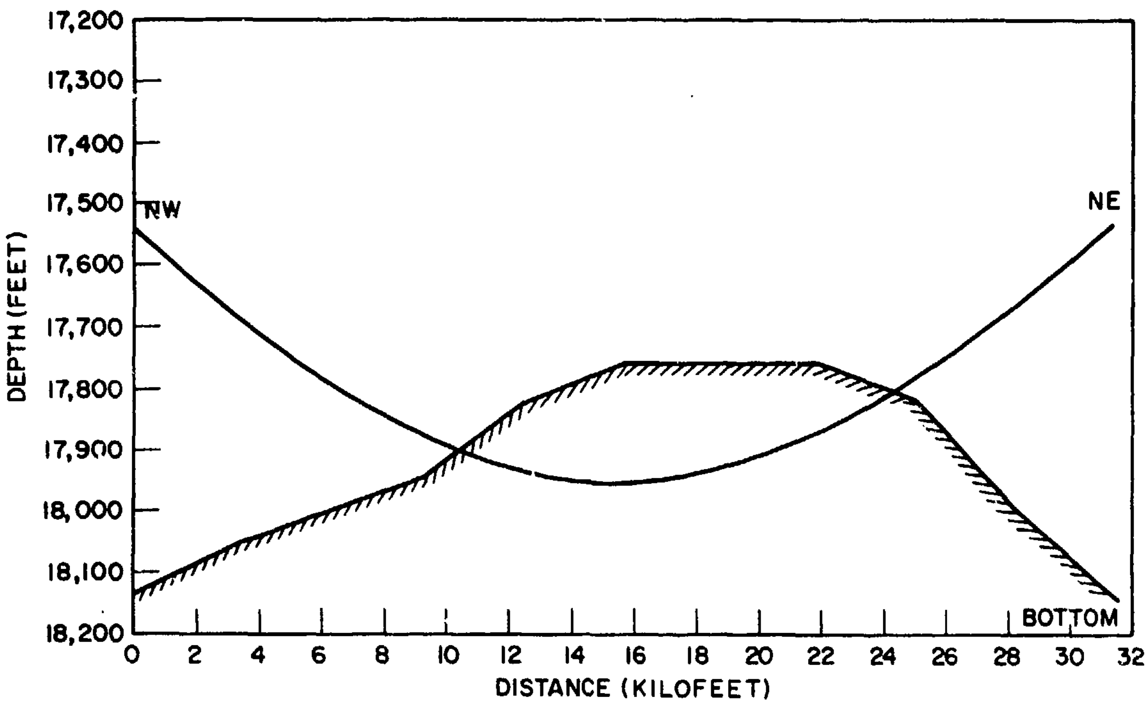


Fig. A-8 - Ray path and bottom profile between NW leg and NE leg for deep source and receiver

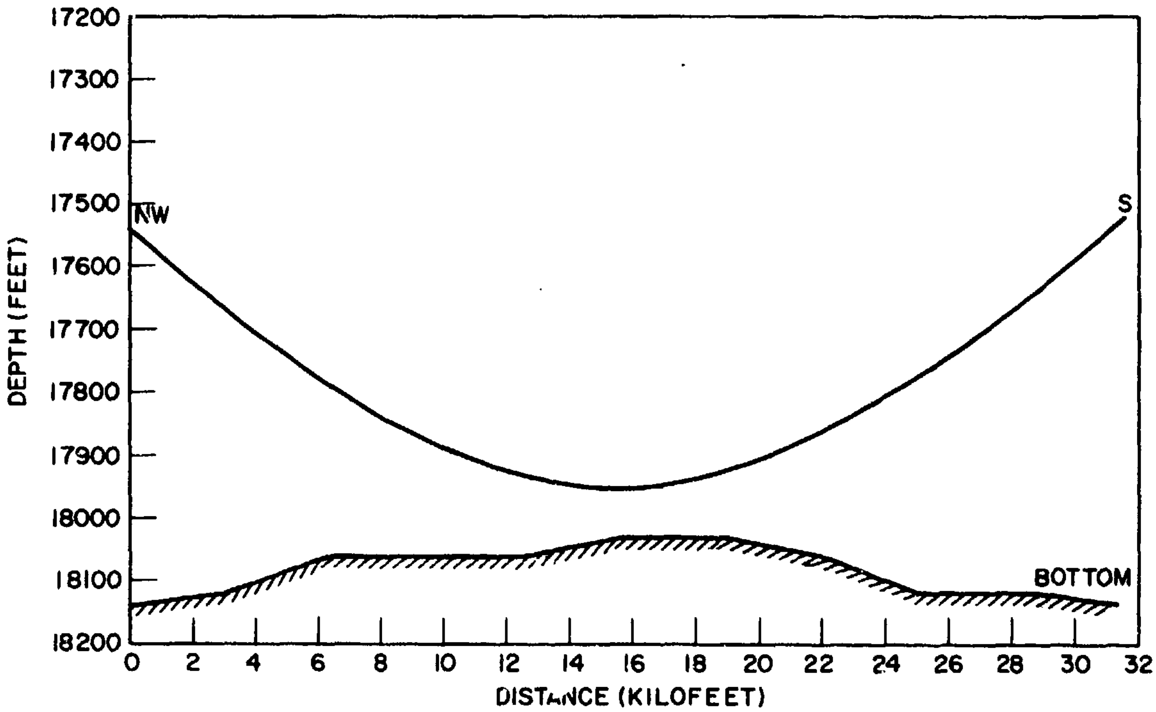


Fig. A-9 - Ray path and bottom profile between NW leg and S leg for deep source and receiver

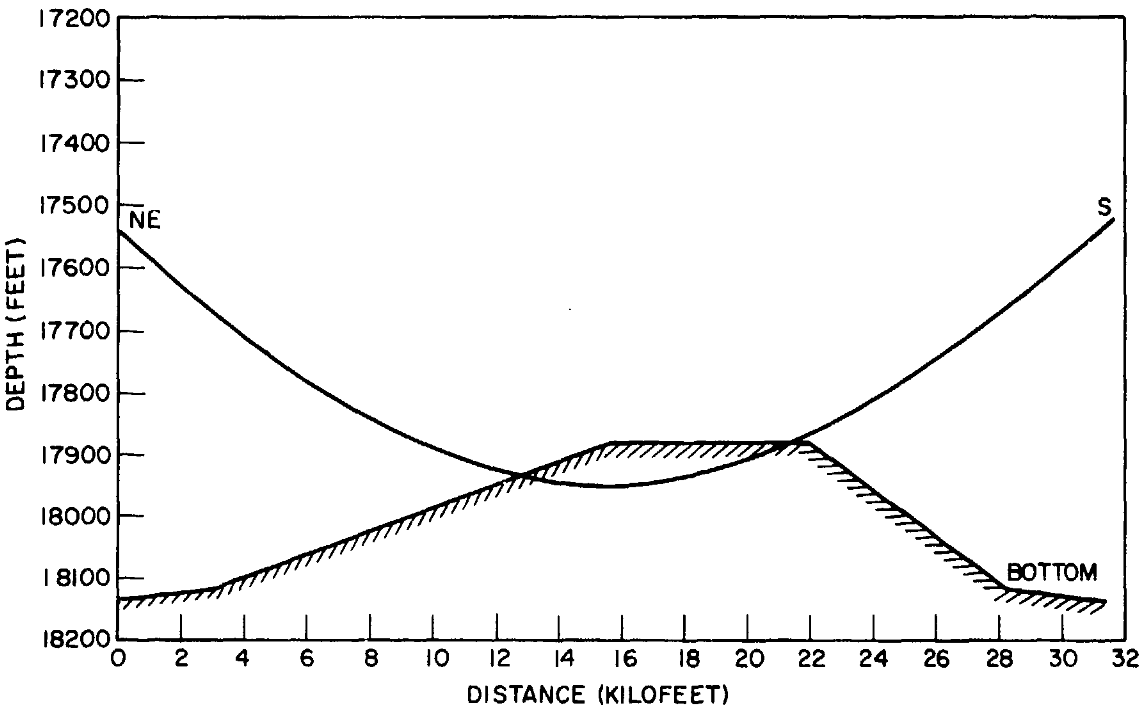


Fig. A-10 - Ray path and bottom profile between NE leg and S leg for deep source and receiver

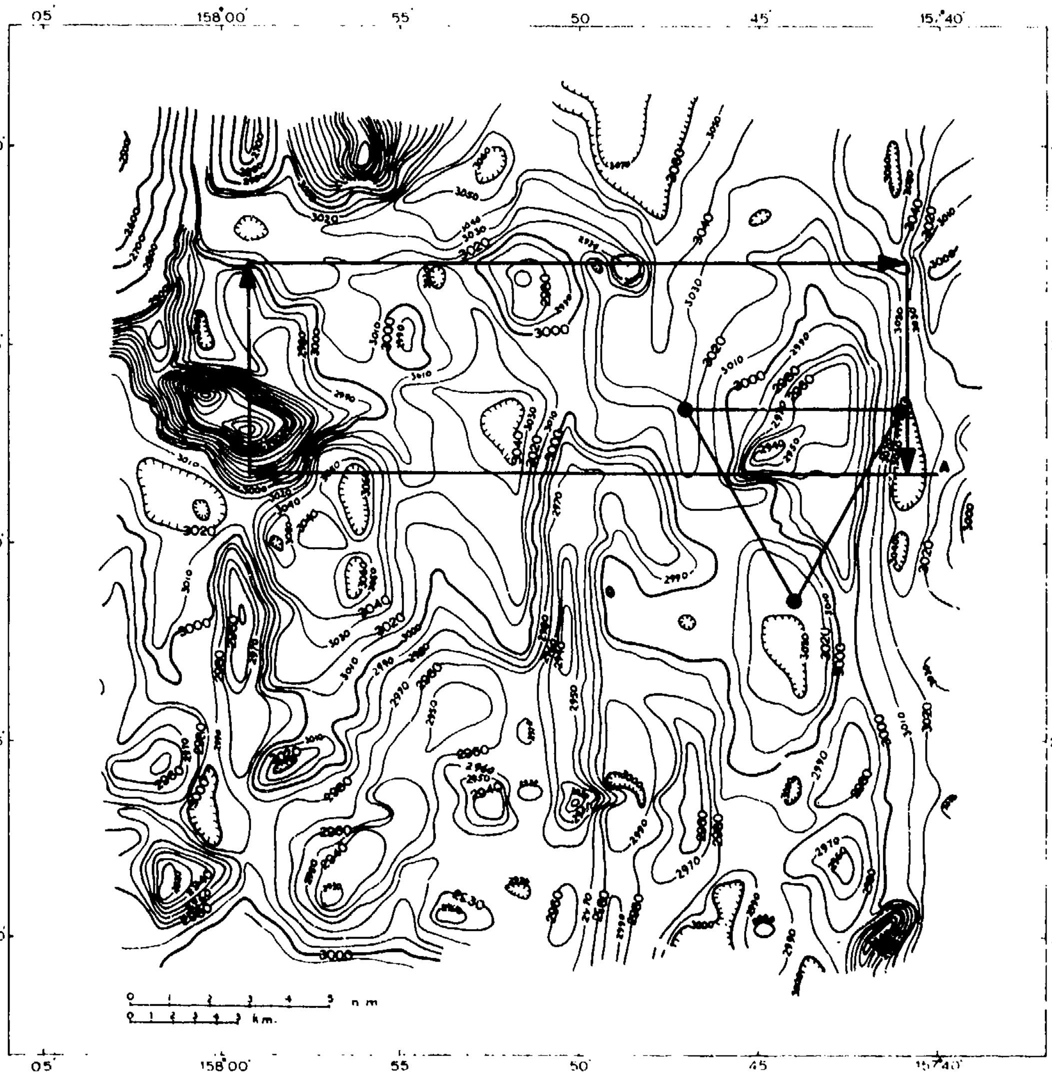


Fig. A-11 - Bottom topography. Depths in corrected fathoms. Contour interval 20 fathoms.

ANNEX B

BRIEF DESCRIPTION OF SEA SPIDER IMPLANTMENT

1. General. The specific procedures and details for implanting SEA SPIDER are contained in Interstate Electronics Corporation Report OM-69, April 1969, Pacific Sea Spider Installation Plan (U).

2. Brief Description of Implantment. The information given in the following paragraphs is intended to provide the reader with a general understanding of the complex operation:

a. SANDS departs Santa Barbara for moor site and makes survey of bottom to recheck navigation and critical depths as shown in existing survey.

b. SANDS drops marker buoy to mark moor center and then proceeds to Honolulu to refuel.

c. RIGBUILDER and SANDS depart Honolulu for moor center to begin implantment.

d. RIGBUILDER deploys free fall anchor near moor center (Figure 1).

e. RIGBUILDER lowers subsurface buoy into water; connects onto pendant from free fall mooring; lowers surface buoy into water; connects umbilical between buoys; connects on N.E. spider leg and proceeds laying cable on surface. (Figure 2).

f. SANDS uses satellite navigator and Omega to locate position of N.E. anchor position and takes station there. RIGBUILDER heads for SANDS paying out cable and affixing glass balls to it. Cable curves with current. (Figure 3).

g. RIGBUILDER attaches leg anchor and lowers to bottom by means of crown line. (Figure 4).

h. SANDS proceeds to position of south anchor and RIGBUILDER returns to moor center where it fastens on south cable leg to subsurface buoy and heads for SANDS, paying out cable and fastening on balls. (Figure 5).

i. RIGBUILDER again fastens on crown line and anchor and lowers south leg.

j. RIGBUILDER returns to moor center, fastens on N.W. leg and pays it out, putting on balls and heading for SANDS which is at N.W. anchor position.

k. RIGBUILDER affixes N.W. anchor crown line and anchor which has pinger to measure height off bottom. SANDS directs RIGBUILDER to bisect angle between N.E. and S anchors by using the acoustic projectors at the bottom of these legs. (Figure 6).

l. RIGBUILDER uses precalculated curves to pull subsurface buoy under and to set N.W. leg anchor on bottom. Buoy is pulled under to about 80 feet. After moor reaches equilibrium anchor is lifted off bottom and buoy is readjusted to 100 foot depth.

m. Crown lines from all buoys are then lowered to ocean floor.

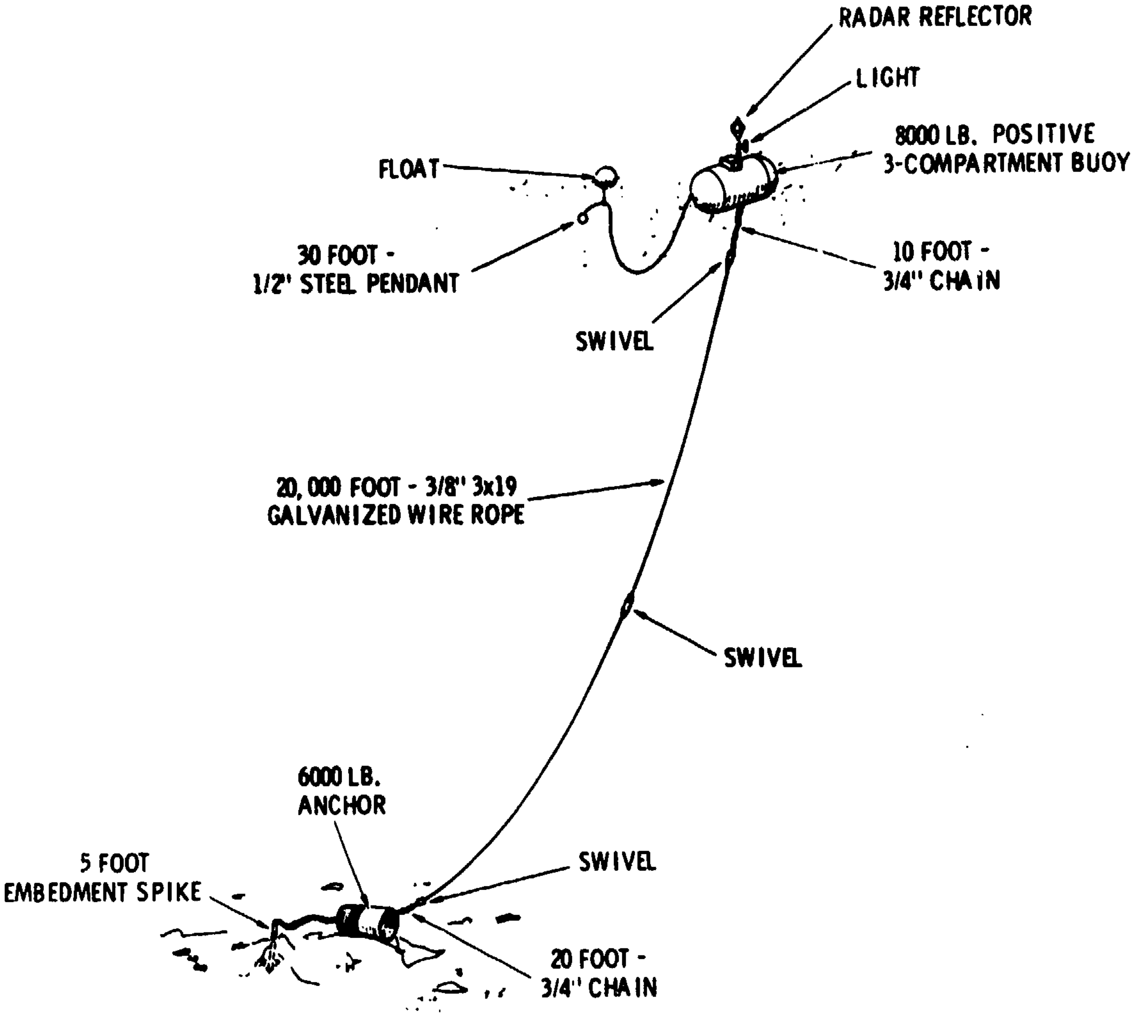


Fig. B-1 - Free-fall mooring system

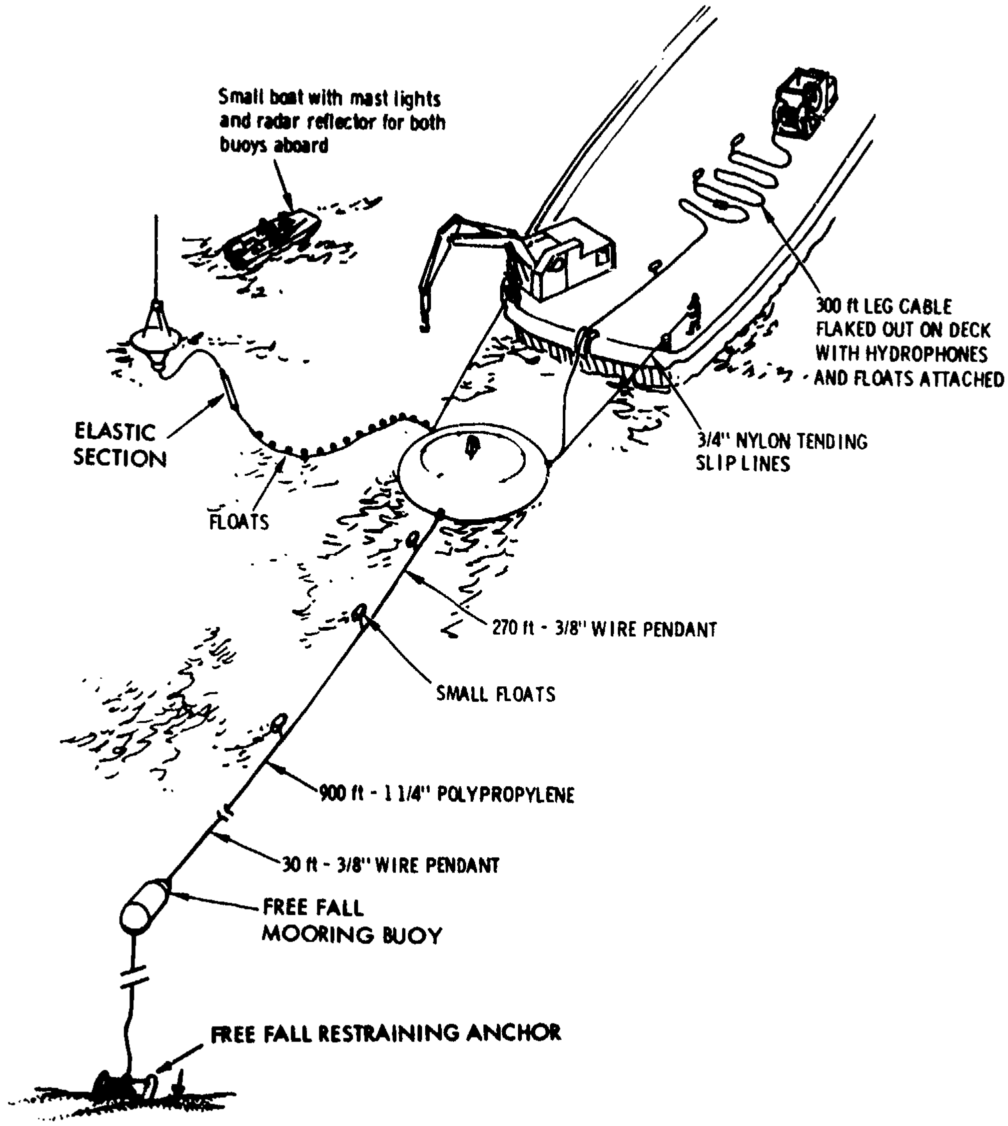


Fig. B-2 - Deployment of subsurface buoy

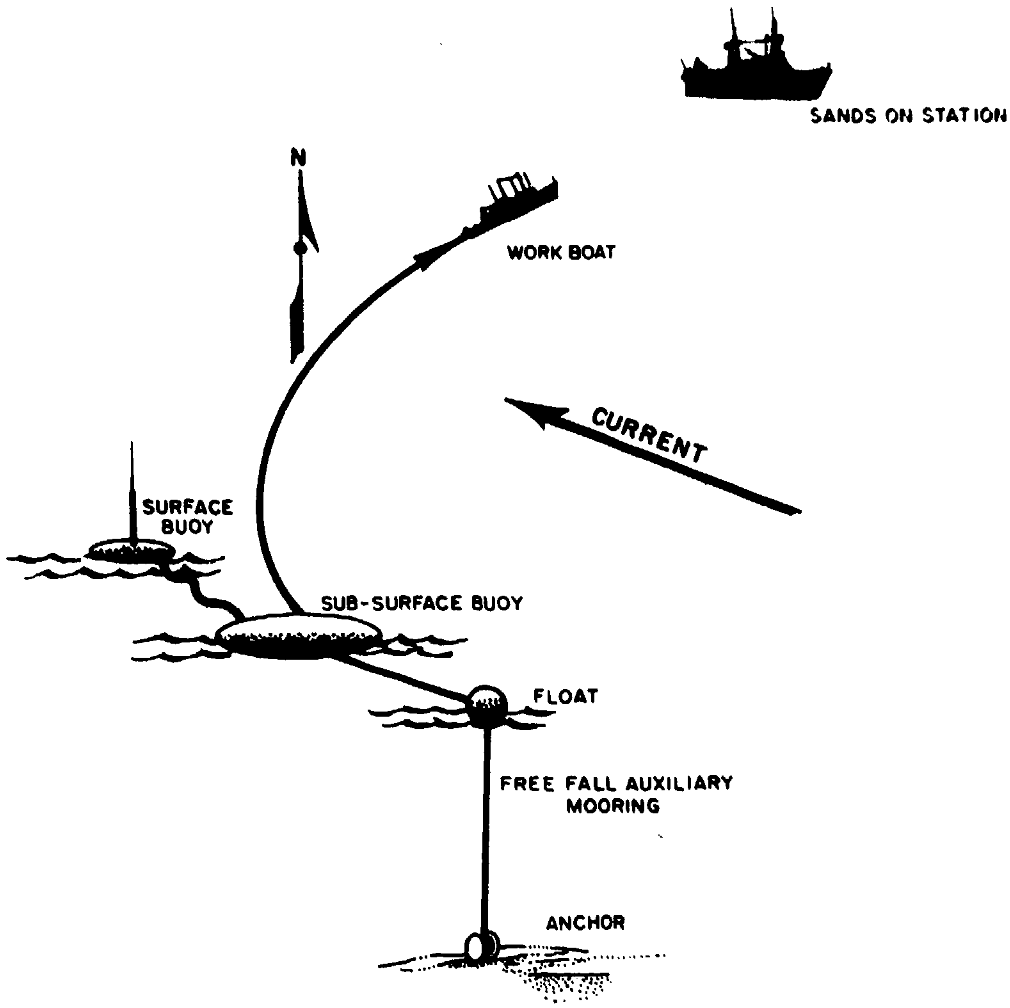


Fig. B-3 - Implanting northeast leg

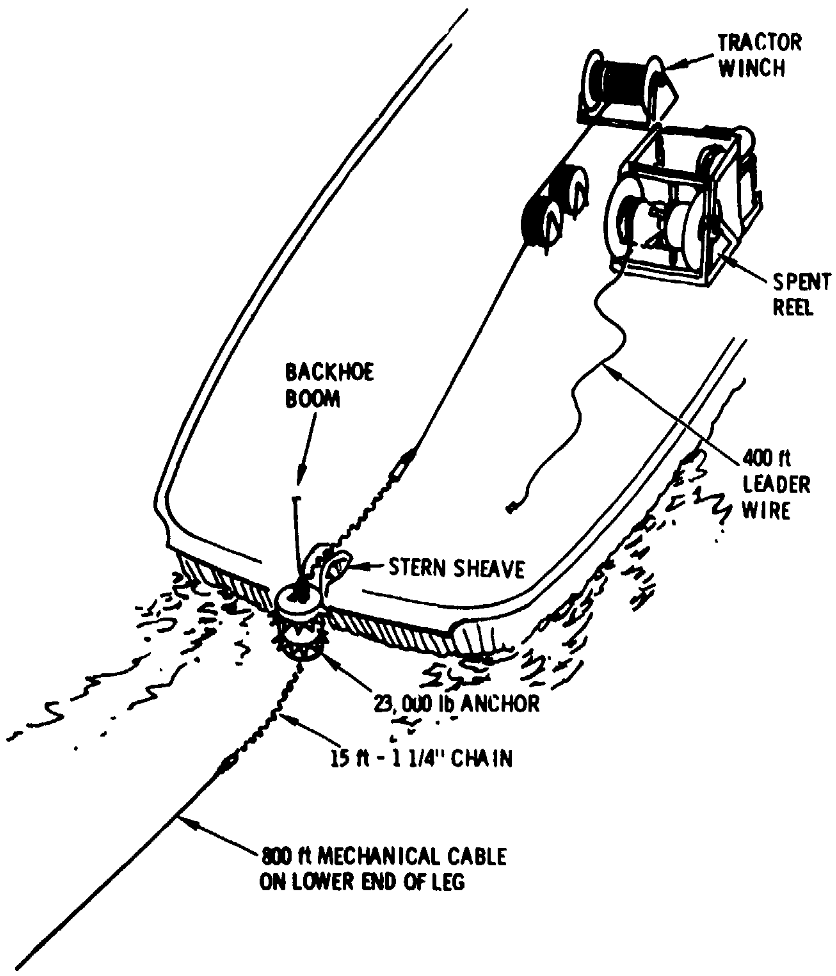


Fig. B-4 - Deployment of leg anchor

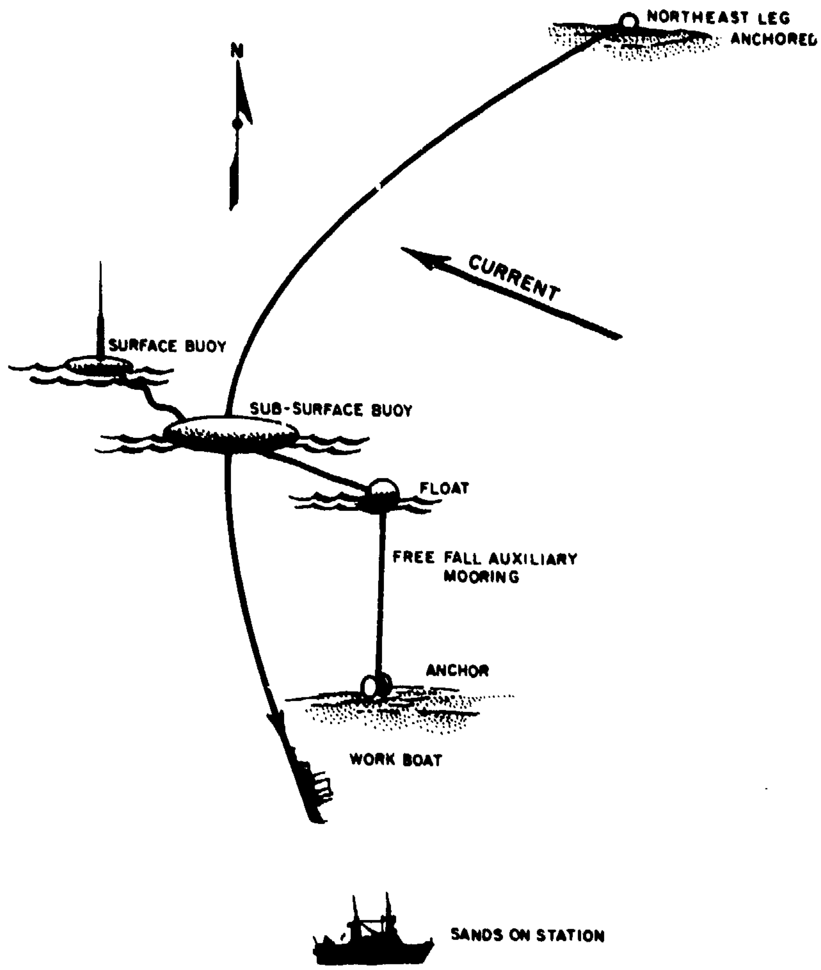


Fig. B-5 - Implanting south leg

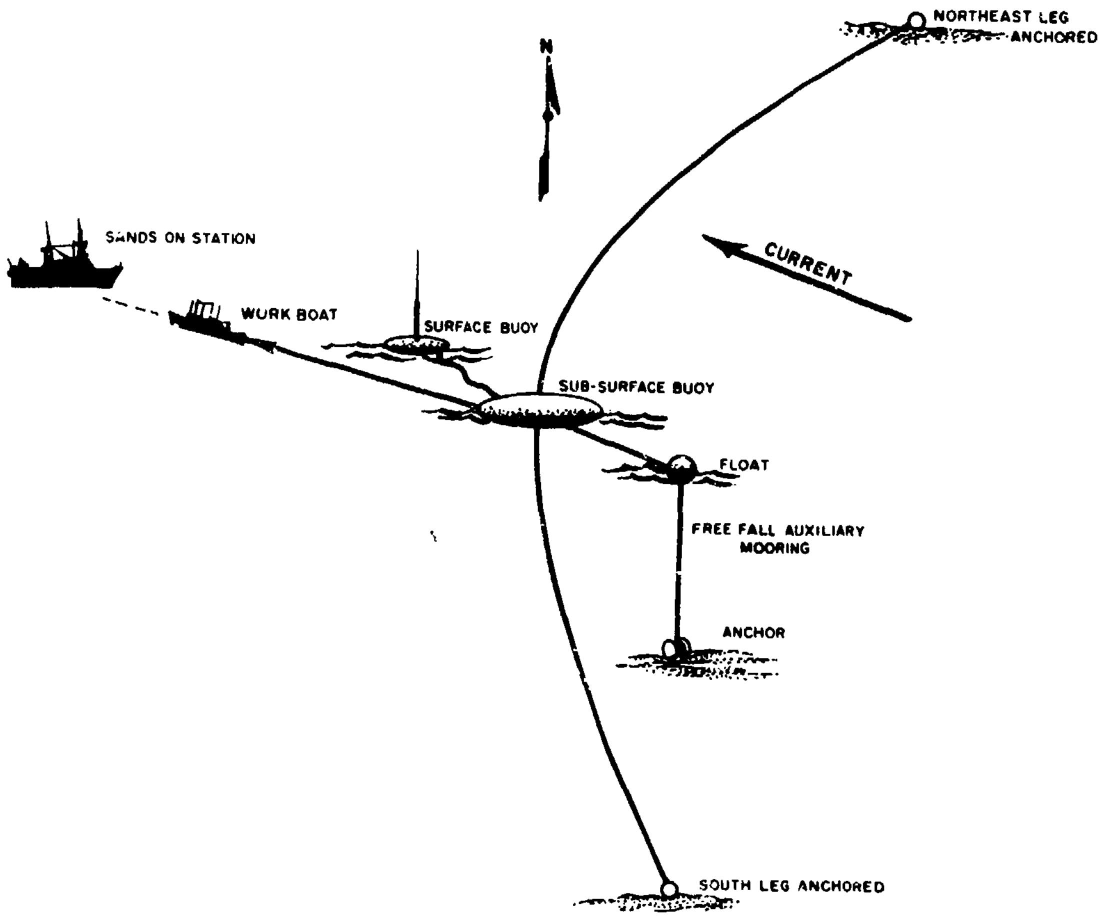


Fig. B-6 – Implanting northwest leg

PARKA II
ONR SCIENTIFIC PLAN 2-69
ANNEX C

Radiological Safety

1. General. The design of the Radioisotope Thermoelectric Generators (RTG) housings virtually guarantees against any leakage of the radioactive fuel. However, it is necessary to establish certain minimum precautions to ensure that exposure of personnel to radioactive material is maintained within safe limits and that the integrity of the generators is preserved. In addition, procedures are established to prevent excessive exposure of personnel to radioactivity in the event of radioactive fuel leak.

2. Radiation Limits. Under normal circumstances, when the generators are functioning properly within the subsurface buoy, the maximum radiation of the skin of the buoy should be less than 10 milliroentgens/hr (mr/hr). A reading greater than 10 mr/hr indicates that an RTG unit may have been damaged to the extent that radioactive fuel is exposed. This condition is designated a radiological accident which requires execution of OPNAV INST. 3040.5 and action by the Naval Nuclear Power Unit (NNPU) personnel as described in Section IIE5.

3. Exposure Considerations

a. It is estimated that each diver may enter the subsurface buoy a maximum of six hours per calendar quarter. The firm stay times will be determined by NNPU personnel when the RTG, are installed in the subsurface buoy about 1 August 1969.

b. To determine a diver's total exposure to radiation during the PARKA II experiment, he will be required to wear a dosimeter. It is expected that the exposure limit for divers will be administratively set at less than 500 milliroentgens per calendar quarter.

c. The specific details for wearing dosimeters, exposure limits and stay times within or in the vicinity of the subsurface buoy will be provided by the Naval Nuclear Power Unit (NNPU) personnel prior to implantment of SEA SPIDER.

4. Survey Requirements

a. Members of the NNPU will make radiological surveys of the subsurface buoy after installation of the RTG and during SEA SPIDER implanting operations.

b. If the subsurface buoy is entered by personnel after RTG's are installed, a "wipe test" must be conducted within a four month period to check for leakage of radioactive material. Wipe tests are carried out using special filter paper on areas of the RTG installation specified by the NNPU. Filter papers obtained during wipe tests will be forwarded, registered mail, by divers to NNPU for analysis, when SANDS returns to port. Special precautions in handling these filter papers after wipe tests are not necessary.

c. Radiological surveys will be conducted, under the supervision of the senior scientist on the scene, whenever the subsurface buoy comes to the surface after implanting. The following guidance is provided for radiological surveys of the subsurface buoy:

(1) Buoy on surface - no apparent damage:	If radiological survey does not exceed 10 mr/hr on approaching and upon contact with the subsurface buoy, the buoy may be treated as being in a normal condition for retrieval and entering.
(2) Buoy on surface - damage probable:	If radiological survey indicates intensity greater than 10 mr/hr but less than 50 mr/hr upon approach or contact with buoy, the buoy may be retrieved but may not be entered. When buoy is on board, personnel will remain clear of the buoy as physical limits of ship permit. There is no danger to personnel unless they receive prolonged exposure to the radioactivity. Administrative limits of 6 hrs/week and 25 hrs/quarter

year should be observed. Exposure time in excess of these limits must be reported to the NNPU.

(3) Buoy on Surface - Damage significant - Exposure of RTG Fuel probable: It is most probable that the subsurface buoy will sink if damage is significant enough to rupture the RTG units. However, should significant damage occur and the buoy remain afloat, then a survey must be conducted to determine whether or not the subsurface buoy can be brought aboard for salvage. As in 4.b. above, if the survey on approach and contact with the buoy measures less than 50 mr/hr, the subsurface buoy may be brought aboard. If the survey indicates between 50 mr/hr and 2.5 roentgens (r)/hr, personnel may attach a line to the subsurface buoy to maintain control of it. The stay time near the buoy to secure lines should be limited to about a half hour. However, longer exposure is permitted by personnel who have not exceeded an exposure level of 300 mr/week. A stay time in the vicinity of the subsurface buoy for an hour or two to attach lines is considered safe. The buoy should not be brought aboard until NNPU personnel have determined that it is safe to do so.

5. Dosimeters - Personnel conducting surveys and working in the vicinity (radiation field greater than 2 mr/hr of the subsurface buoy shall wear dosimeters. Dosimeters shall be forwarded to NNPU for reading and recording every four to six weeks as ship in port periods dictate. Exchange of exposed dosimeters for new dosimeters and

mailing of dosimeters to NNPU will be made by the Project Coordinator.

6. Training and Radiological Equipment - The Naval Nuclear Power Unit will provide training, dosimeters and survey equipment to senior scientists and personnel on SANDS, RIGBUILDER, MAHI and work boats which handle the sub-surface buoy.

7. Radiological Accident - Damage or loss of the RTG units will result in implementing OPNAV Instruction 3040.5 in accordance with Section II.E. of the basic scientific plan for PARKA II. Upon implementation of this instruction, NNPU personnel will be ordered to the scene. Salvage ships ordered to the scene by COMASWFORPAC to retrieve or assist in repairing the moor should proceed expeditiously. OCE should determine by quickest means the estimated arrival time of the NNPU representative so that the representative may board the salvage ship if practicable before the ship proceeds to the scene.

ANNEX D

GUIDANCE FOR RETRIEVAL OR REIMPLANTMENT OF SEA SPIDER MOOR

1. General: This plan is based upon the most cost effective method for retrieving the SEA SPIDER moor. Not all equipment will be retrieved because to do so would require special outfitting of a vessel, the cost of which would be comparable to the implantment cost. However, it is most important that every effort be made to retrieve the subsurface buoy because it contains the Radioisotope Thermoelectric Generators (RTG), and it is valued at $700,000.

2. Retrieval/Salvage Responsibility

a. Emergency Condition: Retrieval/Salvage of the SEA SPIDER moor while the experiment is in progress, whether due to radiological accident or moor casualty, will be considered an emergency condition requiring Navy assistance. Under an emergency salvage situation, COM[illegible]WFORPAC will provide appropriate salvage unit(s) to handle the SEA SPIDER mooring lines and lift the subsurface buoy on board. Technical assistance and guidance for retrieving the moor will be provided by Interstate Electronics Corporation technicians who are on the scene during the experiment.

b. Normal Conditions: Retrieval/Salvage of the SEA SPIDER moor upon completion of the experiment will be planned and contracted for in advance of the retrieval date. A retrieval in this instance is a normal retrieval situation and is the responsibility of appropriate personnel in the Office of Naval Research.

3. Priority of Retrieval: Equipment from the moor should be retrieved in the following order of priority:

a. Subsurface buoy with contents.

b. Surface buoy.

c. Leg hydrophones and associated underwater electronic packages.

d. Leg projectors and electronic packages.

e. Glass buoyancy elements.

f. Other instruments.

g. Strain terminations with about fifteen feet of leg cable attached on each side. Do not disassemble if practical.

h. Umbilical assembly between surface and subsurface buoy.

4. Retrieval Guidance:

a. Expeditious retrieval of the moor may be necessary because of:

(1) Major electronic failure precluding further useful experiments.

(2) Mechanical failure of a leg.

(3) Completion of experiments.

b. The legs of the SEA SPIDER are designed to be slightly buoyant so that during implantment they can be laid out on the surface while attaching the glass balls. If they remain buoyant after implantment they may be brought back to the surface by electrically actuating an explosive release located at the foot of each leg. However, if a number of glass balls have parted from a leg, the leg may not be buoyant and will have to be hauled back to the surface after uncoupling from the

anchor. No attempt will be made to recover anchors.

c. If a leg has parted and sunk to the bottom, no attempt will be made to retrieve the parted length. In the event of such a failure, the subsurface buoy should rise to the surface and, depending upon the sea state, cause the other legs to fatigue and, in time, part also. Therefore, it is imperative that reimplantment or salvage of the moor begin without delay.

5. Reimplantment Guidance: Reimplantment of SEA SPIDER after failure will depend upon many variables including the condition of undamaged equipment, engineering analysis to determine cause of failure, availability of material, personnel, work boats, weather/sea conditions, phase of experiment in progress, and amount of scientific data already obtained. The procedures for reimplanting SEA SPIDER, taking these variables into consideration, is under analysis by the prime contractor, Interstate Electronics Corporation. The decision to reimplant will be made by the LRAP Project Manager, Dr. J. B. Hersey (ONR Code 102-OS), earliest after failure is reported and engineering data is evaluated.

6. Procedure for Salvage of SEA SPIDER Moor: The procedures for salvaging the SEA SPIDER moor and its equipment are listed below for each condition under which salvage can be anticipated:

a. Case I: Parted SPIDER Leg: Subsurface Buoy on Surface

(1) Cut the surface buoy assembly loose from the subsurface buoy. Lift the buoy assembly aboard. Of primary concern in this assembly is the buoy itself and the electronics inside. However, if time permits, it is important to save the entire buoy assembly.

(2) Save the surface buoy painter and electrical umbilical for analysis.

(3) If only two legs are still attached to the subsurface buoy, free the leeward leg by blowing the explosive bolt. In this context, the words leeward or windward refer to the net effect of both wind and current. If the parted leg is still attached to the subsurface buoy, recover this one first as described below.

(4) If the leg comes to the surface as planned, pass the bottom end over a warping drum, being careful not to damage sensors, electronic canisters or glass canisters or glass balls. Cut these appendages free as they come aboard, and carefully mark them for storage.

(5) As the cable goes over the drum, run the free end overboard and jettison it. At each strain termination, cut off about fifteen feet of cable on each side and save the termination and attached cable for analysis purposes. In the event of impending bad weather, attempt to save at least three terminations on each leg, one each from a deep, middle, and shallow depth.

(6) Cut the cable about fifteen feet from the strain termination at the subsurface buoy.

(7) Repeat the procedure for the other two legs, the windward leg being last.

(8) Conduct radiological survey in accordance with NNPU guidance and the Radiological Safety Annex (Annex C).

(9) Using the lifting lugs atop the subsurface buoy, lift it onto the cradle and secure it. Do not open without having radiological monitoring equipment, and observe the safety procedures as stated in Annex C. If the buoy must be towed to port, take extreme precautions to ensure that it does not slam against the ship or break loose. Erect the radar reflector which SANDS has on board. Use a towing bridle affixed to its top and bottom

so that it will tow like a saucer, not like a sea anchor. Tow speeds of over 5 knots appear impracticable.

b. Case II: SEA SPIDER Moor Mechanically Intact

(1) Blow off the leeward anchor so that the subsurface buoy will rise to the surface. Stay well clear of moor center when accomplishing this because the buoy will surface quickly.

(2) Proceed as with Case I.

NOTE: If the anchor release mechanism fails to operate, attempt to release the next leeward anchor. If none are releasable, all legs will have to be dropped. Most importantly do not attempt to have a diver cut taut legs; they are very highly stressed and will whip when cut. In addition, the subsurface buoy will surface very quickly. Instead, use a remote actuated cable cutter to sever the leg.

c. Case III: Subsurface Buoy Adrift

Retrieve the subsurface and surface buoy. In all probability the legs of the moor will not be locatable but if by chance they are, no means will be available to blow off the anchors. Salvage whatever equipment can be saved.

d. Case IV: Subsurface Buoy Has Sunk

In the event the subsurface buoy has sunk no salvage effort is contemplated. However, it should be verified that the subsurface buoy is indeed on the bottom and not adrift. The acoustic transponder on the buoy should be interrogated using the portable sonar interrogator to determine its disposition.

7. Records: An important adjunct of the project is the future analysis of the equipment. Therefore, it is

necessary to maintain a compreh nsive log of the salvage operations so that the positions of all balls, hydrophones and other equipment are readily identifiable. This will necessitate labeling all equipment as it is retrieved. Extensive photographic documentation of the retrieval procedure is desirable.

8. Salvage Equipment: The salvage vessel or retrieving ship should have the following equipment aboard when leaving port to effect retrieval:

a. Decompression chamber.

b. Shark cage.

c. Diver air supply.

d. Buoy cradle.

e. Buoy transponder sonar interrogation equipment.

f. Cable cutters (remote actuated).

g. Cutting torch.

Should it become necessary for a ship already on the scene to attempt an emergency retrieval, the necessary equipment will have to be improvised as much as possible.

9. Technical Supervision: The senior diver-technician on SANDS will provide technical assistance to salvage forces during salvage of the moor.

ANNEX E

DETAILED DESCRIPTION OF EXPERIMENTS

1. General.

(C) There are 15 individual experiments to be performed in PARKA II. These are identified as serially-numbered "EVENTS" as follows:

a. Phase I

21 July - 5 August

EVENT 1 - Bathymetric Tracks

EVENT 2 - SEA SPIDER Survey

b. Phase II

13 August - 3 September

EVENT 3 - SEA SPIDER IMPLANTMENT

EVENT 4 - SEA SPIDER Performance

EVENT 5 - Motion Studies

EVENT 6 - Calibration of Receiving System

EVENT 7 - Noise Measurements

c. Phase III

10 September - 3 October

EVENT 5 - Motion Studies

EVENT 6 - Calibration of Receiving System

EVENT 7 - Noise Measurements

EVENT 8 - Optimum Array Gain

EVENT 9 - Propagation Loss and Arrival Structure

EVENT 10 - Satellite Transmission of Acoustic Data

d. Phase IV

8 October - 28 October

EVENT 6 - Calibration of Receiving System

EVENT 10 - Satellite Transmission of Acoustic Data

EVENT 11 - Propagation Loss and Temporal Fluctuation of CW Signals

e. Phase V

4 November - 29 November

EVENT 5 - Motion Studies

EVENT 6 - Calibration of Receiving System

EVENT 8 - Optimum Array Gain

EVENT 10 - Satellite Transmission of Acoustic Data

EVENT 12 - Temporal Fluctuations and Coherence

EVENT 13 - Long Range Propagation Loss (A/C)

EVENT 14 - Bottom Loss

EVENT 15 - Reverberation Characteristics

f. During each of the acoustic EVENTS, SEA SPIDER will be operated in one or more of six switching modes. The particular mode selected will be determined by experimental requirements. Tables E-1, E-2, and E-3 indicate the depth and number of those sensors that are sampled during operation in each of the SEA SPIDER switching modes.

g. A detailed description of the various EVENTS follows.

TABLE E-1

DEPTHS OF ACOUSTIC TRANSPONDERS AND TEMPERATURE SENSORS

SOUTH LEG (1)		N. E. LEG (2)		N. W. LEG (3)	
Ft.	H.P. No.	Ft.	H.P. No.	Ft.	H.P. No.
		150	A 210	150	A 310
300	A 110			300	A 309
2500	A 109	2500	A 209	2500	A 308
2515	A 108	2515	A 208		
		2538	A 207		
2572	A 107	2572	A 206		
		2623	A 205		
3000	A 106	3000	A 204	3000	A 307
				6000	A 306
10000	A 105	10000	A 203	10000	A 305
10015	A 104				
10072	A 103				
10500	A 102	10500	A 202	10500	A 304
				13000	A 303
				16000	A 302
19000* Nominal	A 101	19000* Nominal	A 201	19000* Nominal	A 301

*Lowest hydrophone will be 600 feet above the sea bed.

The depth of the temperature sensors on each leg are as follows:

SOUTH LEG		N. E. LEG		N. W. LEG	
Ft.	Temp. No.	Ft.	Temp. No.	Ft.	Temp. No.
		150	T-07	150	T-12
300	T-03			300	T-11
2515	T-02	2515	T-06	2500	T-10
2572	T-01	2538	T-05		
		3000	T-04	3000	T-09
				6000	T-08

NOTE: These will be switched with the adjacent hydrophones, i.e., if the hydrophone output is being telemetered in a given switching mode, the associated temperature sensor output will also be transmitted.

TABLE E-2

ACOUSTIC TRANSDUCER SWITCHING MODES

Mode 1

Leg 1: All hydrophones

Leg 2: One at 2515 feet

Leg 3: One at 2500 feet

Mode 2

Leg 1: All hydrophones

Leg 2: None

Leg 3: One at 13000 feet, one at 16000 feet

Mode 3

Leg 1: None

Leg 2: All hydrophones

Leg 3: One at 13000 feet, one at 16000 feet

Mode 4

Leg 1: One at 2572 feet

Leg 2: All hydrophones

Leg 3: One at 2500 feet

Mode 5

Leg 1: One at 2515 feet

Leg 2: One at 2538 feet

Leg 3: All hydrophones

Mode 6

Leg 1: One at 2515 feet. One at 3000 feet.
One at 10015 feet. One at 10072 feet.

Leg 2: One at 2515 feet. One at 2538 feet.
One at 10000 feet. One at 10500 feet.

Leg 3: One at 25000 feet. One at 3000 feet.
One at 10500 feet.

TABLE E-3
MODE SELECTION TABLE
ENGINEERING DATA SENSORS

VHF TLM CHNL.	IRIG CHANNELS NO.	CENTER FREQ. Hz	MODE 1	2	3	4	5	6	7
13	1	400					T-08		T-08
	2	560					T-09		T-09
	3	730	T-10		T-10		T-10	T-10	T-10
	4	960					T-11		T-11
	5	1300	C.S.	C.S.	C.S.	MISC.	T-12	C.S.	T-12
	6	1700	DEP.	DEP.	DEP.	DEP.	DEP.	DEP.	DEP.
14	5	1300	MISC.	MISC.	T-04	T-04	C.S.	MISC.	C.S.
	6	1700			T-05	T-05	T-05	T-05	T-05
	7	2300	T-06	C.D.	T-06	T-06		T-06	
	8	3000			T-07	T-07			
	9	3900	VIBX	VIBX	VIBX	VIBX	VIBX	VIBX	
	10	5400	VIBY	VIBY	VIBY	VIBY	VIBY	VIBY	
15	5	1300	T-01	T-01	MISC.	T-01	MISC.		MISC.*
	6	1700	T-02	T-02			T-02	T-02	T-02
	7	2300	C.D.	C.D.	C.D.	C.D.	C.D.	C.D.	C.D.
	8	3000	TEN1	TEN1	TEN1	TEN1	TEN1	TEN1	TEN1
	9	3900	TEN2	TEN2	TEN2	TEN2	TEN2	TEN2	TEN2
	10	5400	TEN3	TEN3	TEN3	TEN3	TEN3	TEN3	TEN3

NOTE: SEE NEXT PAGE FOR LEGEND:

LEGEND

T-xx	-	Temperature Sensor No. xx
TENx	-	Tension Sensor on Leg No. x
C.S.	-	Current Speed
C.D.	-	Current Direction
VIBY	-	Vibration Sensor, Y-Axis
VIBX	-	Vibration Sensor, X-Axis
MISC	-	Miscellaneous Engineering Data

NOTES:

1. Mode 7 is the High Frequency Telemetry Mode.
2. In Mode 7 the MISC* channel is time shared to produce readouts of the following parameters:

   A. RTG Voltage
   B. RTG Load Current
   C. DC/DC Converter Output
   D. 50 Volt Supply Load Current
   E. Full Scale Calibrate

EVENT 1 - BATHYMETRIC TRACKS (C)

a. (C) Objective

Obtain bathymetric profiles of the tracks that will be traversed by aircraft dropping SUS charges during EVENT 13.

b. Purpose

Bottom topography can have an important effect on the transmission of acoustic energy over long ranges. An accurate bathymetric profile of the ocean bottom is necessary in order to assess the role played by the intervening topography for modeling purposes. In EVENT 13, acoustic signals will be generated by Mk-61 SUS charges air-dropped along four tracks radiating from SEA SPIDER. One of these tracks (due north to Alaska) has been adequately surveyed; those to Adak, Seattle, and San Diego have not, and must be covered by ship-borne echo sounder prior to the commencement of the PARKA II Experiment.

c. Procedures

SANDS, MARYSVILLE, and CONRAD will obtain bathymetric profiles while transitting to SEA SPIDER from the vicinity of San Diego, Seattle, and Adak, respectively. A detailed description of the tracks and the procedures to be followed is contained in Annex F.

EVENT 2 - SEA SPIDER SITE SURVEY (U)

EVENT 3 - SEA SPIDER IMPLANTMENT (U)

Detailed descriptions of these two EVENTS are contained in Annexes A and B.

EVENT 4 - SEA SPIDER PERFORMANCE (U)

a. (U) Objective

Evaluate SEA SPIDER as an acoustic measurements structure.

b. Purpose

Initial observations of all sensors of the SEA SPIDER structure should be made to assure proper operation and to serve as a reference in a continuing study of sensor operation over the total life of SEA SPIDER.

c. Procedures

The SEA SPIDER command control system will be evaluated for all operating modes.

Data to be acquired include:

(1) Ocean temperature versus depth from SEA SPIDER sensors.

(2) Operating characteristics of command control system.

(3) Hydrophone polarity determination using rifle shots.

(4) Hydrophone calibration check using 400 Hz projector at 1000 ft.

(5) Impulse characteristics of SEA SPIDER structure.

(6) Determination of operating range of telemetry system.

d. Support Requirements

(1) SANDS, SEA SPIDER.

(2) Satellite navigation on SANDS.

(3) Command control terminal equipment for SEA SPIDER aboard SANDS.

(4) Source ship to deploy charges for measurement of impulse characteristics of SEA SPIDER structure.

e. Event Time - 3 Days.

EVENT 5 - SEA SPIDER MOTION STUDIES (U)

a. General

The position of the ten hydrophones on the NW leg will be measured as a function of environmental and engineering parameters during the first period of operation after implantment, and at various times thereafter.

b. Manning

During the first period of operation after implantment (Phase II), there will be three men on SANDS for these measurements: an engineer, a technician and a programmer. During Phases II and IV there will be one or two men depending on the findings of the first period. During Phase III one man will be aboard if required.

c. Ships

The SEA SPIDER monitoring ship (SANDS) is the only ship required. All operations can be carried out from that ship.

d. Ship Location

There is no critical location unless a SEA SPIDER source fails and a transponder must be used. In the case of failure of the source, the ship should be with 3 miles of the transponder, horizontally.

e. Ship Maneuvering

Not required unless a transponder becomes necessary. In this case, SANDS will be required to lower the transponder and drag it slowly towards the anchor of the leg on which the source has failed. The transponder will be released as near to the anchor as possible.

f. Operations

SANDS will transmit over the SEA SPIDER command link "transducer power on", "transducers select", and 8 cycle 1 kHz signal burst signals and will receive acoustic and engineering data over the telemetry link.

Each SEA SPIDER source will be pinged once, in sequence,

with at least 10 seconds between pings to allow all receptions to be obtained and transducers to be switched. It is anticipated these will occur every 10 to 15 minutes throughout the day. Received signals will be recorded as will a timing signal and the engineering data. Weather and sea state data will be logged at least once an hour and velocity profiles will be taken before commencing a day, at noon, and at the end of the day.

EVENT 6 - CALIBRATION OF RECEIVING SYSTEM (C)

a. Objective

Calibrate the various operating modes of SEA SPIDER to insure its continued operation as a linear system with a known calibrated response.

b. Procedure

Prior to each acoustic experiment, and at such intervals as appears necessary, a calibration of the various channels of SEA SPIDER will be made to insure that the structure and its electronic systems are operating properly. This will be an idependent measurement between SEA SPIDER and SANDS, using an acoustic projector overside from SANDS to produce known signals in the water, and also using the internal system calibration circuitry built into SEA SPIDER. SEA SPIDER will be cycled through appropriate operating modes and response characteristics will be observed on SANDS.

c. Support Requirements

(1) SANDS and SEA SPIDER

(2) Satellite navigation on SANDS

(3) Command control terminal equipment for SEA SPIDER aboard SANDS.

EVENT 7 - NOISE MEASUREMENTS (U)

a. Objective

Determine background noise as a function of depth and evaluate SEA SPIDER as an acoustic measurements structure.

b. Purpose

Ambient noise level is not expected to be invariant with depth. Its characteristic with depth is important in system design concepts.

c. Procedures

(1) Immediately following the SEA SPIDER implantment, ambient noise and temperature measurements will be made at several depths using AUTOBUOY. These data will be analysed on SANDS and compared with similar data obtained at the output of the SEA SPIDER hydrophones and temperature sensors. Subsequent to the initial noise measurements, the later measurements with the SEA SPIDER may or may not include deployment of AUTOBUOY depending upon the initial results obtained.

(2) Data to be acquired include:

(a) Ambient noise spectrum level versus frequency and depth from AUTOBUOY using a fast Fourier transform program on the UNIVAC 1230 or a continuous filter bank depending on computer utilization.

(b) Background noise spectrum level from SEA SPIDER hydrophones processed in same manner as AUTOBUOY data.

(c) SANDS radiated noise for various operating modes.

(3) SANDS will be required to:

(a) Launch and retrieve AUTOBUOY.

(b) Process data from SEA SPIDER and AUTOBUOY.

(c) Take XBT every six hours.

(d) Command mode changes in SEA SPIDER operation.

d. Support Requirements

(1) SANDS, SEA SPIDER.

(2) AUTOBUOY deployed from SANDS.

(3) 60 XBT's (2,500 ft.) on SANDS.

(4) Satellite Navigator on SANDS.

(5) Command control terminal equipment for SEA SPIDER aboard SANDS.

e. Event time - 3 days.

EVENT 8 - OPTIMUM ARRAY GAIN (C)

a. Objective

Evaluate optimum array gain by adaptive null processing techniques.

b. Purpose

Theoretical adaptive array studies have indicated the possibility of achieving higher effective array gains in operationally significant situations than those obtained using conventional techniques.

c. Procedures

(1) SANDS will monitor SEA SPIDER while emitting a broadband signal from a source lowered from SANDS at fixed ranges from SEA SPIDER. Two arrays on legs 1 and 2 will be used.

Data to be acquired include:

(a) Array patterns resulting from optimizing the array gain.

(b) Noise correlation characteristics.

(2) Array depth will be 2500 and 10,000 feet. The processing band for the optimum array gain studies will be 200 - 400 Hz and the noise correlation data will be obtained in the 100 - 1000 Hz frequency range.

(3) SANDS will be required to:

(a) Lower a 400 Hz broadband projector to 1200 ft.

(b) Take XBT's every six hours.

(c) Process all data.

(d) Maintain position to ± 1/4 mile.

d. Support Requirements

(1) SANDS, SEA SPIDER.

(2) 60 XBT's (2500 ft) and launcher.

(3) 400 Hz projector.

(4) Satellite Navigator on SANDS.

e. Event time - one three day period and one five day period.

EVENT 9 - PROPAGATION LOSS AND ARRIVAL STRUCTURE (C)

a. Objective

Determine angle of arrival and energy partitioning among arrivals at SEA SPIDER from charges detonated at 60 and 500 feet at various ranges and bearings from SEA SPIDER to 600 miles.

b. Purpose

(1) Fixed receivers will permit critical comparison of measurement with prediction by simplifying geometry.

(2) Determining energy partitioning will test adequacy of model assumptions.

(3) Bottom loss data can be obtained for comparison with MGS results.

(4) Multiple bearings will permit the environmental sensitivity of the acoustic signal and prediction model to be examined over a wider latitude of parameter variability.

c. Procedures

(1) SANDS will monitor SEA SPIDER while CONRAD detonates three pound charges at one mile increments alternating in depth between 60 and 500 feet. Data to be acquired include:

(a) Angle of arrival for the various multipaths associated with each shot.

(b) Propagation loss of each arrival in frequency band (50-250 Hz).

(c) Total propagation loss in five frequency bands (25, 50, 100, 200, 400 Hz).

(2) Angle of arrival will be determined for the 2500 and 10,000 foot hydrophone locations. Propagation loss will be measured at the four major depth intervals of legs 1 and 2 when running radially to these legs. When CONRAD runs radially to leg 3, propagation loss will be measured at all depths and angle of arrival measurements will be deleted.

(3) Seven radial runs (300 or 500 miles long) as indicated in Annex G are planned.

(a) Run 1, 2, 3

SEA SPIDER -- Mode 1: Angle of arrival and single path propagation loss-hydrophones A102, 103, 105, 106, 107, 109; Total propagation loss-hydrophones A101, 105, 109, 110, 208, 308.

(b) Run 4, 5

SEA SPIDER -- Mode 4: Angle of arrival - A202, 203, 204, 206, 209; Total propagation loss - A201, 203, 209, 210, 308, 107.

(c) Runs 6 and 7

SEA SPIDER -- Mode 5: Propagation loss - A108, 207, 301, 302, 305, 306, 309, 310.

(4) Aircraft required to drop AXBT's every 25 nm during Runs 1, (2 or) 3, (4 or) 5, and (6 or) 7.

(5) CONRAD will be required to:

(a) Detonate charges synchronized with a radio transmitted shot instant mark.

(b) Obtain a bathymetric profile while acting as source ship.

(c) Maintain a track using a satellite navigator.

(d) Obtain an XBT every six hours.

d. Support Requirements

(1) SANDS, CONRAD, SEA SPIDER.

(2) CONRAD-3600 shots for 60 feet.

(3) CONRAD-3600 shots for 500 feet.

(4) CONRAD-bottom profiling system.

(5) CONRAD-84 XBT's (2500 foot) plus launcher.

(6) 80 XBT's (2500 foot) plus launcher on SANDS.

(7) Satellite navigator on SANDS and CONRAD.

(8) Compatible radio communication equipment on SANDS and CONRAD.

(9) 72 AXBT's.

e. Event time -- 14 days.

EVENT 10 - SATELLITE TRANSMISSION OF ACOUSTIC DATA (C)

a. Objective

Determine the feasibility of employing a satellite transponder to relay underwater acoustic data from SEA SPIDER to a shore based receiver.

b. Purpose

A high capacity telemetry data channel could eliminate the need for an instrumentation ship in proximity to a SEA SPIDER type installation. If experiment is successful it is conceivable that an instrumented buoy could replace SANDS, or perhaps a simply instrumented ship could relay data to a shore activity for computer processing.

c. Procedures

The output signals of SEA SPIDER hydrophones will be telemetered by SANDS via satellite to NRL/USL.

(1) Experiment 1

(a) The shot propagation experiment (EVENT 9) presently consists of seven independent runs. The execution of one of these runs can be made to coincide with the time the satellite can be scheduled. A desirable run is the one designated Run 4 which consists of a propagation loss run 500 nm radially to the NE of SEA SPIDER. This experiment will be conducted on two days in Phase III during EVENT 9.

(b) Eight hydrophone outputs will be telemetered via satellite. Each of these phones will be processed to obtain total energy in the same frequency bands used on SANDS.

(2) Experiment 2

(a) During the CW propagation loss experiment (EVENT 11) in Phase IV, 8 runs are planned for this period of 3 weeks. One run can be planned to coincide with the time period scheduled on the satellite.

(b) Eight outputs will be telemetered.

(c) The phase fluctuations measured between

A107, and A308 will be correlated with the same measurements to be made on SANDS to determine the extent to which the satellite link perserves this information.

(3) Experiment 3

Dates: One 12 hour period in Phase V during aircraft long range propagation runs (EVENT 13). One aircraft run will be planned to coincide with the scheduled satellite time. If this is impractical, one ship station will be planned in place of the aircraft run. Eight outputs will be telemetered.

d. General Requirements

(1) One FM transmitter site on SANDS.

(2) Receiver sites at USL and NRL. Data to be recorded on direct writing pen recorder plus a magnetic tape recorder. Processing of magnetic tape to be accomplished off-line.

EVENT 11 - PROPAGATION LOSS AND TEMPORAL FLUCTUATION OF CW SIGNALS (C)

a. Objectives

Determine propagation loss and fluctuation of received energy from CW sources at 60 and 500 ft at various ranges and bearings from SEA SPIDER to 500 miles.

(1) Fixed receivers will permit critical comparison of measurement with prediction by simplifying geometry.

(2) CW sources allow measurements to be made under conditions of phase-sensitive multipath summation permitting studies of fading rates for use in detection probabilities.

(3) Multiple bearings will permit the environmental sensitivity of the acoustic signal and prediction model to be examined over expanded parameters.

b. Procedures

(1) SANDS will monitor SEA SPIDER while CONRAD tows a 178 Hz source at 500 or 60 ft emitting 2 harmonically related CW signals. Data to be acquired include:

(a) Propagation loss for 5 minute averages of the received signal.

(b) Variance of received signal over 5 minute periods.

(c) Spectrum of the envelope of the received signal (50 min period).

(d) Co-spectrum of harmonically related signals.

(e) Signal-to-noise comparison between measurements using incoherent and coherent processing of harmonically related signals.

(f) Average phase fluctuation between element pairs at 2500 ft depth for constant source bearing.

(2) All measurements except (f) above will be made at the four major depth intervals of legs 1 and 2 when

running radially to these legs. During runs 6 and 7 these measurements will be made at six depths of leg 3.

(3) Eight radial runs (300 or 500 miles long) as indicated in Annex G are planned. At the end of each even numbered run CONRAD will hold position and continue operating the source at 60 ft for two hours and then at 500 ft for two hours in order to obtain measurements of temporal fluctuations. The SEA SPIDER mode will be the same as used for the run most recently completed.

(a) Run 1 and 3 - SEA SPIDER Mode 1: source depth 500 ft; all measurements except phase fluctuation at A110, 109, 106, 105, 102, 101, 208 and 308; phase measurements between A208 and 308.

(b) Run 2 and 8 - SEA SPIDER Mode 1: source depth 60 ft; all measurements same as Runs 1 and 3.

(c) Run 4 - SEA SPIDER Mode 4: source depth 60 ft; all measurements except phase fluctuations at A210, 209, 204, 203, 202, 201, 107 and 308; phase fluctuations at A107 and 308.

(d) Run 5 - SEA SPIDER Mode 4: source depth 500 ft; all measurements same as Run 4.

(e) Run 6 - SEA SPIDER Mode 5: source depth 60 ft; all measurements except phase fluctuations at A310, 309, 308, 306, 305, 301, 108 and 207.

(f) Run 7 - SEA SPIDER Mode 5: source depth 500 ft; measurements same as Run 6.

(4) CONRAD will be required to:

(a) Tow 6,000 lb 178 Hz source at 60 ft and 500 ft.

(b) Obtain a bathymetric profile while acting as source ship.

(c) Maintain track using satellite navigator.

(d) Obtain XBT every six hours.

(e) Detonate shot every hour for range indexing.

c. Support Requirements

(1) SANDS, CONRAD and SEA SPIDER.

(2) CONRAD - hoist mechanism for launching and retrieving 6,000 lb projector.

(3) CONRAD - faired cable for towing source at 10 kts.

(4) CONRAD - bottom profiling system.

(5) CONRAD - 500 shots for 500 ft.

(6) CONRAD - 130 XBT's (2,500 ft) plus launcher.

(7) SANDS - 130 XBT's (2,500 ft) plus launcher.

(8) Satellite navigator on SANDS and CONRAD.

(9) Compatible radio communications equipment on SANDS and CONRAD.

d. Event time - 16 days.

EVENT 12 - TEMPORAL FLUCTUATIONS AND COHERENCE (C)

a. Objective

Determine level fluctuations of received signals and perform spatial and replica correlation on different signal types from a source at fixed ranges on different bearings.

b. Purpose

(1) Fixed receivers and a stationary source will permit an analysis of temporal changes in the ocean on propagation loss and array gain.

(2) Different bearings and ranges will permit the environmental sensitivity of the acoustic signal to be examined.

c. Procedures

(1) SANDS will monitor SEA SPIDER while CONRAD takes station at two bearings and 12 ranges from SEA SPIDER to 1000nm. At each station two signal types (CW, LFM) will be transmitted at each of two depths (60' and 500') over a 12 hour period.

(2) Data to be acquired include:

(a) Cross correlation of each pulse reception with a reference.

(b) Cross correlation of hydrophone pairs at the array depths (2500 ft., and 10,000 ft.) of leg 1.

(c) 1st order statistics (mean and variance) of the correlation values and the received levels.

(3) Twelve stations along a line running due north and south through the SEA SPIDER location will be selected based on results of earlier propagation loss experiments. SEA SPIDER Mode 2 will be used for reference and cross correlation of signal pairs as indicated:

(109, 107)	(105, 104)	(R,110)
(109, 106)	(105, 103)	(R,109)

(109, 108) (105, 102) (R, 105)

(R, 101)

Mode 6 will be used for cross correlation and reference correlation of signal pairs as follows:

(208, 308)	(203, 304)	(208, R)	(203, R)
(207, 307)	(202, 304)	(308, R)	(304, R)

where R denotes reference signal.

(4) CONRAD will be required to:

(a) Hold position to ± 1/2 nm at each station.

(b) Pulse CW source with various signal types of 2 and 10 sec duration.

(c) Obtain a bathymetric profile while between stations.

(d) Obtain an XBT every six hours while on station.

d. Support Requirements

(1) SANDS, CONRAD, SEA SPIDER.

(2) CONRAD - CW Source (178 Hz, 6,000 lb).

(3) CONRAD - Hoist mechanism for handling projector.

(4) CONRAD - Instrumentation for generating different pulse types.

(5) CONRAD - Bottom profiling system.

(6) 60 XBT's (2,500 ft.) plus launcher on CONRAD.

(7) 60 XBT's (2,500 ft.) plus launcher on SANDS.

(8) Satellite navigator on SANDS and CONRAD.

(9) Compatible communications equipment on SANDS and CONRAD.

e. Event time - 12 days.

EVENT 13 - LONG RANGE PROPAGATION LOSS (A/C) (C)

a. Objective

Obtain data for various bathymetric environments and velocity structures to determine effect on long range, low frequency acoustic propagation.

b. Purpose

(1) Validate propagation loss model over long ranges, different environments.

(2) Determine the surveillance capabilities of a SEA SPIDER type structure with respect to propagation loss.

c. Procedures

(1) The parameters of interest are receiver depth and bearing of the track from SEA SPIDER. Mk 61 SUS charges will be used and the received energy analyzed in 5 frequency bands (25, 50, 100, 200 and 400 Hz). A round-trip flight will be flown on each of four great circle tracks from SEA SPIDER to each of the following positions:

(a) 51°55'N 176°34'W

(b) 32°43'N 117°12'W

(c) 55°00'N 157°44'W

(d) 48°17'N 122°37'W

(2) During each round trip, the tracks are listed in descending order of interest, with (a) the most important. Shots will be detonated at 60 feet on the outgoing leg and at 800 feet on the return leg from an aircraft approximately every eight miles. Total propagation loss will be measured. Mode 5 of SEA SPIDER will be used for these runs. Ten hydrophone outputs will be processed and a noise sample will be taken prior to each shot arrival.

(3) In addition, SANDS personnel are requested to report at the end of Phase V any apparent malfunctions in SUS charge detonation for a quality-control report to NAVAIRSYSCOM. Such a report will contain the following

information for each run: good shots; duds; apparent malfunction in detonation depth; and, apparent improper source level. (See Annex K)

d. Support Requirements

(1) Aircraft navigation accuracy 5% of range.

(2) 2400 Mk 61 SUS charges (500 set at 60' and 500 set at 800').

(3) 320 AXBT's (AXBT taken every 25nm in one direction on each track).

(4) 50 XBT's and STD or SVP system on SANDS.

e. EVENT time - approximately 10 to 12 hours each flight.

EVENT 14 - BOTTOM LOSS (C)

a. Objective

Measure bottom loss as a function of frequency and grazing angle along tracks used for acoustic propagation loss studies in the PARKA II experiments.

b. Purpose

(1) Measurement of bottom loss in the PARKA II Experiment area will permit a direct input of those data to the prediction model for comparison with measured propagation loss.

(2) Bottom loss data obtained can be compared with MGS results.

c. Procedures

(1) Two ships (SANDS and CONRAD) and SEA SPIDER are required to conduct these measurements. SANDS will monitor SEA SPIDER and hold station using its bow thruster. CONRAD will open range from SANDS detonating explosives at 500 and 2,500 ft. depths. The following measurement will be made:

(a) Difference between direct and bottom reflected energy each corrected for spherical spreading.

(b) Comparison of bottom loss as determined by singly and doubly reflected signals for the same grazing angles. Measurements will be made in 1/3 octave bands between 50 and 1000 Hz. The 500 ft. explosives will be used for grazing angles greater than 10 degrees and 2500 ft. explosive will be used at the shallow angles less than 10 degrees.

(2) CONRAD will be required to:

(a) Detonate charges synchronized with a radio transmitted shot instant marker.

(b) Obtain a bathymetric profile while acting as source ship.

(c) Obtain one deep sediment core from measurement areas.

(3) SANDS will be required to:

(a) Position itself on station with satellite navigation.

(b) Take an XBT at each station.

d. Support Requirements

(1) System for deep velocimeter cast.

(2) Communication and navigation systems employed by both ships during the major PARKA II operations.

(3) One-third octave band filters used by SANDS for PARKA II operations.

(4) 400 3lb. TNT charges for 500 ft. detonation.

(5) 120 Mk 59 Mod 4 SUS charges set to detonate at 2500 ft.

(6) 8 XBT's (2500 ft.) plus launcher.

EVENT 15 - REVERBERATION CHARACTERISTICS (C)

a. Objective

Measure the reverberation characteristics of a large area of the Pacific Ocean centered at SEA SPIDER.

b. Purpose

Reverberation is often the limiting factor against which active systems must process information. A clear understanding of the reverberation structure for such a system will facilitate determining design criteria.

c. Procedure

Detonate 2 depth charges from CONRAD at a depth of 3000 ft., in vicinity of SEA SPIDER. SANDS will monitor and record the outputs of selected SEA SPIDER hydrophones.

d. Support Requirements

(1) SANDS, SEA SPIDER.

(2) CONRAD with depth charge launching equipment.

(3) 2 depth charges for detonation at 3000 ft.

e. Event time - 6 hours.

ANNEX F

OCEANOGRAPHIC MEASUREMENTS AND DATA TRANSMISSION

1. Ship Operations; General

a. All ships will collect pertinent meteorological data daily at 0000, 0600, 1200, and 1800 GMT and keep a log of such information. All ships will sample sea surface temperature every two hours while underway and tabulate the readings on Sea Surface Temperature Log 3167/71-A (3-68), which will be provided prior to the beginning of the experiment. Logs are not to be transmitted, but should be delivered to the OCC at the end of each phase of the experiment. Sea surface temperatures should be measured by bucket thermometer; in the absence of a reliable bucket thermometer, injection temperatures are acceptable.

b. Bathythermographs (BT's) and Expendable BT's (XBT's) are to be coded and transmitted as outlined for Bathythermograph Log 3167/10-A (1-68), copies of which will be provided prior to the commencement of the experiment. All XBT traces are to be identified with ship name, position, date, time, and consecutive number, and will be delivered to the OCC at the end of each phase of the experiment.

c. Sound velocity or Salinity-Temperature-Depth (STD) cast data shall be coded using the HISTD code and transmitted as outlined for the Radio Transmission Log for Salinity, Temperature, Depth, and Sound Velocity Data 3167/43 (7-68), copies of which will be provided prior to the commencement of the experiment. Completed logs and any analog traces, paper tapes, or other velocimeter output will be delivered to the OCC at the end of each phase of the experiment.

d. All ships equipped to do so will collect accurate bathymetric profiles whenever operating along one of the PARKA tracks. In order to accomplish this, shipboard echo sounders will be operated continuously while underway on any of the specified tracks, and the following information will be noted on the trace itself: exact GMT time

every hour; course and speed changes as they occur; course and speed every six hours when course and speed are constant. In addition, the Senior Scientist on Board (SSOB) shall see to it that accurate navigational logs are kept, and that copies of these are attached to the appropriate fathogram. Bathymetric records and associated logs will be delivered to the OCC at the end of each phase of the experiment.

2. Pre-Experiment Ship Operations.

a. USNS SANDS will collect a bathymetric profile along the great circle track running from 32°43'N, 117°12'W to 27°31.6'N, 157°44'W, starting at about 100 fathoms depth off Point Loma, while on her transit from Santa Barbara to the latter point during the period 21 - 30 July. Bathymetric records and associated navigational logs will be delivered to the OCC upon arrival in Hawaii.

b. USS MARYSVILLE will collect a bathymetric profile along the great circle track running from 48°17'N, 122°37'W to 27°31.6'N, 157°44'W, starting at about 100 fathoms depth off Cape Flattery while on her transit from Seattle to Pearl Harbor during the period 21 July - 2 August. Bathymetric records and associated navigational logs will be delivered to the OCC upon arrival in Hawaii.

c. R/V CONRAD will collect a bathymetric profile from a point on the 100-fathom curve off the southeastern tip of Adak Island along the great circle track from 51°55'N, 176°34'W to 27°31.6'N, 157°44'W while on her transit from Adak to Pearl Harbor during the period 18 - 28 August. Bathymetric records and associated navigational logs will be delivered to the OCC upon arrival in Hawaii.

3. Phase I Ship Operations

a. (1) USNS SANDS will collect fine-grained bathymetry during a survey of the proposed SEA SPIDER site in the area around 27°31.6'N 157°44'W during the period 30 July - 5 August. These data will be handled as described in 1d above.

(2) SANDS will make an XBT drop every six hours beginning at 0000Z (1400 local) daily. XBT data will be

coded as described in 1b above and will be delivered to the OCC upon arrival in Hawaii.

4. <u>Phase II Ship Operations</u>.

a. (1) USNS SANDS will make an XBT drop at 0600 and 1800Z (2000 and 0800 local) daily, while on station near 27°31.6'N during the period 13 August - 3 September. XBT data will be coded as described in 1b above and transmitted to the OCC via the Scientific Radio Network once a day.

(2) SANDS will take a deep velocimeter station daily at 0000Z (1400 local). Sound velocity data will be coded as described in 1c above and transmitted to the OCC via the Scientific Radio Network once a day.

b. (1) USS MARYSVILLE will make an XBT drop at 0000Z and 1200Z (1400 and 0200 local) daily, while on station near 27°31.6'N during the period 14 - 30 August. XBT data will be coded as described in 1b above and transmitted to the OCC once a day.

(2) MARYSVILLE will take a deep velocimeter station daily at 1200Z (0200 local). Sound velocity data will be coded as described in 1c above and transmitted to the OCC via the Scientific Radio Network once a day.

5. <u>Phase III Ship Operations</u>.

a. (1) USNS SANDS will make an XBT drop at 0600Z and 1800Z (2000 and 0800 local) daily, while on station with SEA SPIDER during the period 10 September - 3 October. XBT data will be coded as described in 1b above and transmitted to the OCC via the Scientific Radio Network once a day.

(2) SANDS will take a deep velocimeter station daily at 0000Z (1400 local). Sound velocity data will be coded as described in 1c above and transmitted to the OCC via the Scientific Radio Network once a day.

b. (1) USS MARYSVILLE will collect bathymetric profiles while underway on the PARKA tracks during the period 14 September - 2 October. Data will be handled as described in 1d above.

(2) MARYSVILLE will make an XBT drop every six hours beginning at 0000Z (1400 local) daily (or more frequently if a change of morethan 2°C in surface temperature since the last drop is noted) while underway on the PARKA tracks. XBT data will be coded as described in 1b above and transmitted to the OCC via the Scientific Radio Network once a day.

(3) MARYSVILLE will take deep velocimeter stations along the PARKA tracks at the following approximate distances from SEA SPIDER:

Run 1 : 200 and 100 miles

Run 2 : 0, 100, 200 and 300 miles

Run 3 : 400, 300, 200 and 100 miles

Run 4 : 0, 100, 200, and 300 miles

Run 5 : 400, 300, 200, and 100 miles

Run 6 : 0, 100, 200, and 300 miles

Run 7 : 400, 300, 200, and 100 miles

The range from SEA SPIDER to the first station on Runs 3, 5, and 7 can be adjusted to allow MARYSVILLE to get underway back toward SEA SPIDER six hours before CONRAD does so. This should give both ships approximately the same ETA at SEA SPIDER. Sound velocity data should be coded as described in 1c above and transmitted to the OCC via the Scientific Radio Network once a day.

c. (1) R/V CONRAD will collect bathymetric profiles while underway on the PARKA tracks during the period 15 September - 2 October. Data will be handled as described in 1d above.

(2) CONRAD will make an XBT drop every six hours beginning at 0000Z (1400 local) daily (or more frequently if a change of more than 2°C in surface temperature since the last drop is noted) while underway on the PARKA tracks. XBT data will be coded as described in 1b above and transmitted to the OCC via the Scientific Radio Network once a day.

(3) CONRAD will take deep STD stations at the end of PARKA Runs, 2, 4, and 6. STD data will be coded as described in 1c above and transmitted to the OCC via the Scientific Radio Network once a day.

6. Phase IV Ship Operations

a. USNS SANDS will operate in the same manner as during Phase III (Section 5a applies) during the period 8 - 28 October.

b. USS MARYSVILLE will operate in the same manner as during Phase III (Section 5b applies) during the period 8 - 27 October except for the following: Three additional deep sound velocimeter stations will be taken on Run 8 at 0, -100, and -200 miles from SEA SPIDER.

c. R/V CONRAD will operate in the same manner as during Phase III (Section 5c applies) during the period 9 - 28 October except for the following: One additional STD station will be taken at the end of Run 8.

d. (1) USS REXBURG will collect bathymetric profiles while underway on the PARKA tracks during the period 8 - 28 October. Data will be handled as described in 1d above.

(2) REXBURG will make an XBT drop every six hours beginning at 0000Z (1400 local) daily (or more frequently if a change of more than 2°C in surface temperature since the last drop is noted) while underway on the PARKA tracks, whenever the thermistor chain is not deployed. XBT data will be coded as described in 1b above and transmitted to the OCC via the Scientific Radio Network once a day.

(3) REXBURG will collect a continuous temperature profile to a depth of 800 feet using a towed thermistor chain to a distance of about 372 miles from SEA SPIDER along each of PARKA Runs 2 through 7, and to 330 miles along tracks 1 and 8. The exact range achieved on Runs 2, 4, and 6 should be adjusted to allow REXBURG to get underway back toward SEA SPIDER approximately 12 hours before CONRAD does so. Hourly averages of thermistor readings will be coded using the standard BATHY code described in 1b above and selected ones transmitted to the OCC once a day.

7. Phase V Ship Operations

a. USNS SANDS will operate in the same manner as during Phase III (Section 5a applies) during the period 4 - 29 November.

b. (1) USS MARYSVILLE will collect a bathymetric profile while underway on the PARKA track from 22°N to 36°N, and back to 22°N, during the period 5 - 22 November. Data will be handled as described in 1d above.

(2) MARYSVILLE will make XBT drops in the same manner as during Phase III (Paragraph 5b (2) applies) while underway northbound on the PARKA track during the period 5 - 18 November. While returning to port along the PARKA track during the period 18 - 22 November, XBT drops will only be made at 0000Z and 1200Z (1400 and 0200 local) daily.

(3) MARYSVILLE will take deep velocimeter stations at 12 locations on the PARKA track between 24°45'N and 35°45'N during the period 5 - 18 November. Total station time at each location will be about 18 hours; two or three deep velocimeter casts should be made at each location. The exact station time should be adjusted to maintain a position approximately half way between CONRAD and SEA SPIDER. Sound velocity data should be coded as described in 1c above and transmitted to the OCC via the Scientific Radio Network once a day.

c. (1) R/V CONRAD will collect a bathymetric profile while underway on the PARKA track from 22°N to 44°N, and back to 22°N, during the period 5 - 22 November. Data will be handled as described in 1d above.

(2) CONRAD will make XBT drops during the period 5 - 18 November at the following times for each of 12 acoustic stations:

(a) Immediately after arriving on station

(b) Six hours after arriving on station

(c) Immediately prior to getting underway after a station

(d) Halfway between stations

Adjustments may be made to this schedule to allow for an XBT drop approximately every six hours. XBT data will be handled as described in 1b above.

(3) CONRAD will make XBT drops at 0000Z and 1200Z (1400 and 0200 local) while transitting the PARKA track from 44°N to 22°N during the period 18 - 22 November, and every six hours beginning at 0000Z daily while operating with SANDS during the period 22 - 29 November. XBT data will be handled as described in 1b above.

d. (1) USS REXBURG will collect a bathymetric profile during the period 4 - 22 November while towing the thermistor chain along the PARKA track from 22°N to about 44°N, and while returning to 22°N with the chain secured. Data will be handled as described in 1d above.

(2) REXBURG will make XBT drops whenever the chain is not deployed in the same manner as during Phase IV (Paragraph 6d (2) applies) while underway northbound on the PARKA track during the period 4 - 19 November. While returning to port along the PARKA track with the chain secured during the period 19 - 22 November, XBT drops will only be made at 0000Z and 1200Z (1400 and 0200 local) daily.

(3) REXBURG will make thermistor chain measurements in the same manner as during Phase IV (Paragraph 6d (3) applies) while underway on the PARKA track from SEA SPIDER to 46°N during the period 4 - 19 November.

8. Aircraft Operations; Short Range Flights

a. During the periods 15 September - 2 October and 9 - 28 October, a total of eight flights by P-3 aircraft from Fleet Air Wing Two will be made along the 300 and 500 mile long tracks radiating from SEA SPIDER. On each flight, Airborne Expendable Bathythermographs (AXBT's) will be dropped at 25 mile intervals in one direction along each of the PARKA tracks. The exact scheduling will be coordinated with ship movements during Phases III and IV, and will depend on the progress of the experiment.

b. AXBT traces, tapes, and logs will be picked up at Barbers Point Naval Air Station by OCC personnel and handcarried to Fleet Weather Central, Pearl Harbor for digitization and analysis. Digitized and/or

plotted AXBT data will be made available for evaluation by the OCC staff.

9. Aircraft Operations; Long Range Flights

a. During the period 6 - 30 November, four round-trip flights by P-3 aircraft will be made from SEA SPIDER at 27°31.6'N, 157°44'W along selected great circle paths averaging 2200 miles in length. AXBT's will be dropped at 25-mile intervals along one leg of each track. The exact scheduling will be coordinated with ship movements during Phase V, and will depend on the progress of the experiment.

b. AXBT data and flight logs containing navigational data information will be picked up by OCC personnel at Barbers Point NAS and handcarried to FWC Pearl Harbor and the OCC for analysis.

ANNEX G

INDIVIDUAL SHIP AND AIRCRAFT SCHEDULES (C)

1. Ship Operations (C)

a. General

(1) A total of six ships will participate in the various phases of PARKA II, four of which carry out the experimental portions of the exercise. M/V RIGBUILDER is the primary SEA SPIDER implantment ship, and will participate only in Phase II. R/V MAHI will participate in Phases II through V, but only as a monitoring vessel to keep SEA SPIDER under surveillance while the other ships are in port between phases.

During Phases III, IV and V, SANDS will provide SEA SPIDER monitoring and acoustic data analysis services. She will maintain position within seven miles of SEA SPIDER during the experimental periods of these three phases. R/V CONRAD will be the source ship for the acoustic experiments, and will open range to up to 1,000 miles on various bearings from SEA SPIDER. USS MARYSVILLE will carry out oceanographic observations between CONRAD and SEA SPIDER, and USS REXBURG will tow a thermistor chain along these same tracks.

(2) A detailed schedule for each ship follows.

b. USNS SANDS Schedule (C)

Day	Date	Time	Event
0	14 Jul	0800	Arrive Santa Barbara for outfitting.
PHASE I			
7	21 Jul	0800	Depart Santa Barbara. Bathymetric track San Diego to SEA SPIDER (EVENT 1).
16	30 Jul	-	Arrive SEA SPIDER - site survey (EVENT 2).
22	5 Aug	1800	Depart SEA SPIDER.
24	7 Aug	0600	Arrive Pearl Harbor.
PHASE II			
28	11 Aug	1800	Depart Pearl Harbor
30	13 Aug	1000	Arrive SEA SPIDER - relocate moor center.
31	14 Aug	0500	SEA SPIDER implantment (EVENTS 3, 4, 5, 6, 7).
51	3 Sep	1600	Depart SEA SPIDER.
53	5 Sep	0800	Arrive Pearl Harbor
PHASE III			
57	9 Sep	0600	Depart Pearl Harbor
58	10 Sep	2200	Arrive SEA SPIDER. Commence single ship PHASE III measurements (EVENTS 5, 6, 7, 8).

Day	Date	Time	Event
63	15 Sep	0800	Commence EVENT 9 with CONRAD. During EVENT 9 satellite relaying of data (EVENT 10) will be conducted for one of the runs.
81	3 Oct	0400	Depart SEA SPIDER.
82	4 Oct	2000	Arrive Pearl Harbor.
PHASE IV			
85	7 Oct	0600	Depart Pearl Harbor
86	8 Oct	2200	Arrive SEA SPIDER (EVENT 6).
87	9 Oct	0800	Commence PHASE IV Experiments with CONRAD (EVENT 11). During EVENT 11, satellite relaying of data (EVENT 10) will be conducted for one of the runs.
106	28 Oct	0800	Depart SEA SPIDER.
107	30 Oct	0000	Arrive Pearl Harbor
PHASE V			
112	3 Nov	0600	Depart Pearl Harbor.
113	4 Nov	2200	Arrive SEA SPIDER (EVENT 6).
114	5 Nov	0800	Commence EVENTS 5 and 12. During Phase V, satellite relaying of data (EVENT 10) will be conducted for one of the runs of EVENT 13.
115	6 Nov	0800	Conduct EVENT 13, Adak and return: about 24 hours between each run. EVENT 12 when EVENT 13 not in progress. EVENTS 5 and 8 when CONRAD transitting.

Day	Date	Time	Event
120	11 Nov	0800	Conduct EVENT 13, San Diego and return: about 24 hours between each run. EVENT 12 when EVENT 13 not in progress. EVENTS 5 and 8 when CONRAD transitting.
127	18 Nov	-	End EVENT 12.
127	18 Nov	0800	EVENT 13 due north and return. About 24 hours between each run. EVENTS 5 and 8 to be interleaved with EVENT 13.
131	22 Nov	1800	Commence EVENT 14 with CONRAD in vicinity of SEA SPIDER.
134	25 Nov	0800	EVENT 13, Seattle and return: about 24 hours between each run. EVENTS 5 and 14 to be interleaved with EVENT 13.
138	29 Nov	0800	Conduct EVENT 15 with CONRAD and SANDS in vicinity of SEA SPIDER.
138	29 Nov	1800	Complete Phase V experiments. Depart SEA SPIDER
140	1 Dec	1000	Arrive Pearl Harbor.

c. R/V CONRAD Schedule (C)

Day	Date	Time	Event
45	28 Aug	-	Arrive Pearl Harbor - shipboard installation of CW source and helihut.
PHASE III			
60	12 Sep	-	Depart Pearl Harbor. Conduct independent oceanographic studies and seismic measurements with CW source.
63	15 Sep	0800	Arrive at 22°N, 157°44'W, commence EVENT 9 Run 1: proceed 000°T SOA 10 kts, alternating 500' and 60' shots 11 each per hour.
64	16 Sep	1600	Pass SEA SPIDER. End Run 1, start EVENT 9 Run 2: 000°T SOA 10 kts.
66	18 Sep	1800	End Run 2 at 500 nm north of SEA SPIDER. Obtain oceanographic data at this position.
67	19 Sep	1800	Start EVENT 9 Run 3: 180°T SOA 10 kts.
69	21 Sep	2000	End Run 3 at SEA SPIDER. Start EVENT 9 Run 4: 060°T SOA 10 kts.
71	23 Sep	2200	End Run 4 at 500 nm 060°T from SEA SPIDER. Obtain oceanographic data at this position.
72	24 Sep	2200	Start EVENT 9 Run 5: 240°T SOA 10 kts.
74	26 Sep	2400	Pass SEA SPIDER. End Run 5, start EVENT 9 Run 6: 240°T SOA 10 kts.

Day	Date	Time	Event
77	29 Sep	0200	End Run 6 at 500 nm 240°T from SEA SPIDER. Obtain oceanographic data at this position.
78	30 Sep	0200	Start EVENT 9 Run 7: 060°T SOA 10 kts.
80	2 Oct	0400	End Run 7 at SEA SPIDER. Depart for Pearl Harbor.
81	3 Oct	1800	Arrive Pearl Harbor.
PHASE IV			
86	8 Oct	2200	Depart Pearl Harbor.
87	9 Oct	0800	Start EVENT 11 Run 1: 000°T SOA 10 kts from 22°N 157°44'W, towing CW source at 500'.
88	10 Oct	1600	Pass SEA SPIDER. End Run 1, start EVENT 11 Run 2: 000°T SOA 10 kts, CW source at 500'.
90	12 Oct	1800	End Run 2 500 nm 000°T from SEA SPIDER. Perform EVENT 11 temporal fluctuation studies and oceanographic measurements.
91	13 Oct	1800	Start EVENT 11 Run 3: 180°T SOA 10 kts, CW source at 60'.
93	15 Oct	2000	End Run 3 at SEA SPIDER. Start EVENT 11 Run 4: 060°T SOA 10 kts., CW source at 60'.
95	17 Oct	2200	End Run 4 500 nm 060°T from SEA SPIDER. Perform EVENT 11 temporal fluctuation studies and oceanographic measurements.
96	18 Oct	2200	Start EVENT 11 Run 5: 240°T SOA 10 kts., CW source at 500'.

Day	Date	Time	Event
98	20 Oct	2400	End Run 5 at SEA SPIDER. Start EVENT 11 Run 6: 240°T SOA 10 kts., CW source at 500'.
101	23 Oct	0200	End Run 6 500 nm 240°T from SEA SPIDER. Perform EVENT 11 temporal fluctuation studies and oceanographic measurements.
102	24 Oct	0200	Start EVENT 11 Run 7: 060°T SOA 10 kts., CW source at 60'.
104	26 Oct	0400	End Run 7 at SEA SPIDER. Start EVENT 11 Run 8: 180°T SOA 10 kts., CW source at 60'.
105	27 Oct	1300	End Run 8 at 330 nm 180°T from SEA SPIDER. Perform EVENT 11 fluctuation studies and oceanographic measurements.
106	28 Oct	1300	Depart for Pearl Harbor.
106	28 Oct	2300	Arrive Pearl Harbor.

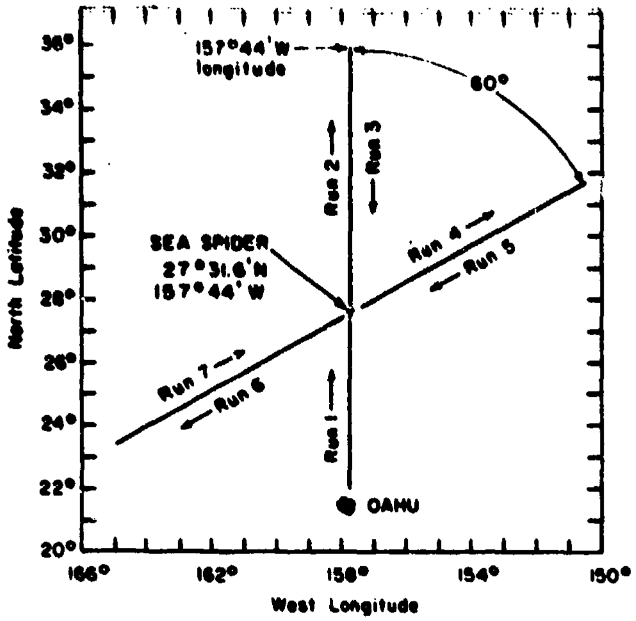
PHASE V

Day	Date	Time	Event
113	4 Nov	2200	Depart Pearl Harbor.
114	5 Nov	0800	Commence EVENT 12. CONRAD will take several stations along 1320 nm track from 22°N 157°44'W to 44°N 157°44'W.
127	18 Nov	-	Depart last station of EVENT 12, at 44°N 157°44'W. Depart for SEA SPIDER. Conduct oceanographic studies enroute.
131	22 Nov	1800	Commence EVENT 14 with SANDS. Conduct oceanographic studies.
138	29 Nov	0800	Conduct EVENT 15 with SANDS deploying large charges so as to

Day	Date	Time	Event
			not damage SEA SPIDER.
138	29 Nov	1800	Complete Phase V measurements. Depart SEA SPIDER.
140	1 Dec	1000	Arrive Pearl Harbor.

CONRAD TRACK CHART

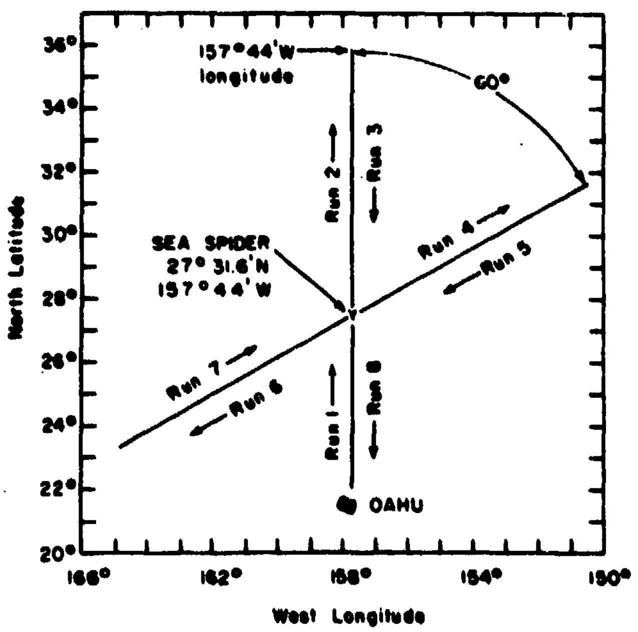
PHASE III



Notes:

1. Run I: 330 miles long
2. Run 2-7: 500 miles long
3. Stations at ends of Runs 2,4,& 6

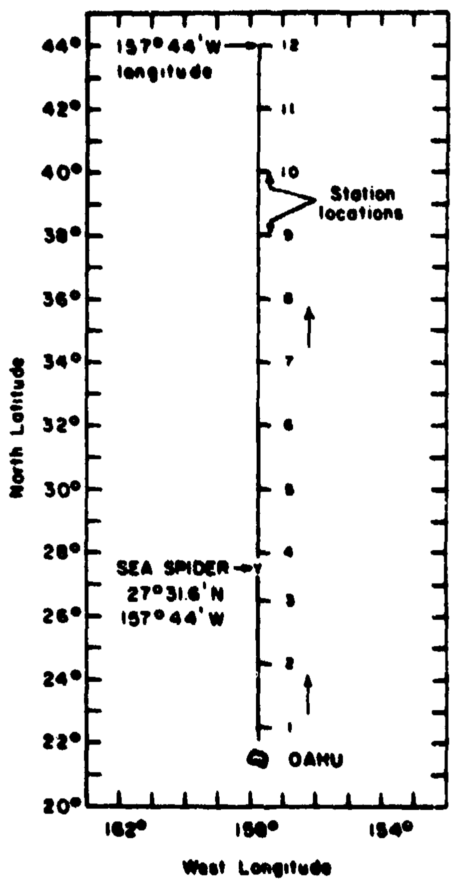
PHASE IV



Notes:

1. Runs 1 & 8: 330 miles long
2. Runs 2-7: 500 miles long
3. Stations at ends of Runs 2, 4, 6, & 8

PHASE V



Notes:

1. Phase V track: 1320 miles long
2. Exact station locations to be determined during experiment
3. CONRAD will return to SEA SPIDER after Station 12. Several short runs will then be made in the vicinity of SEA SPIDER

d. USS MARYSVILLE Schedule (C)

Day	Date	Time	Event
1	15 Jul	-	Depart San Diego for Seattle.
5	19 Jul	-	Arrive Seattle.
PHASE I			
7	21 Jul	-	Depart Seattle - bathymetric track to SEA SPIDER site (EVENT 1).
17	31 Jul	-	Arrive SEA SPIDER site - End EVENT 1.
19	2 Aug	-	Arrive Pearl Harbor.
PHASE II			
29	12 Aug	0800	Depart Pearl Harbor
31	14 Aug	0000	Arrive SEA SPIDER site.
31	14 Aug	0500	Begin SEA SPIDER implantment (EVENT 3). Provide surveillance and housekeeping. Detonate charges for EVENT 4.
47	30 Aug	-	Depart SEA SPIDER - installation complete
49	1 Sep	-	Arrive Pearl Harbor.
PHASE III			
62	14 Sep	1000	Depart Pearl Harbor
62	14 Sep	2000	Start EVENT 9 Run 1: 000°T, from 22°N 157°44'W 12 hours before CONRAD. Occupy stations at -200 mi and -100 mi.

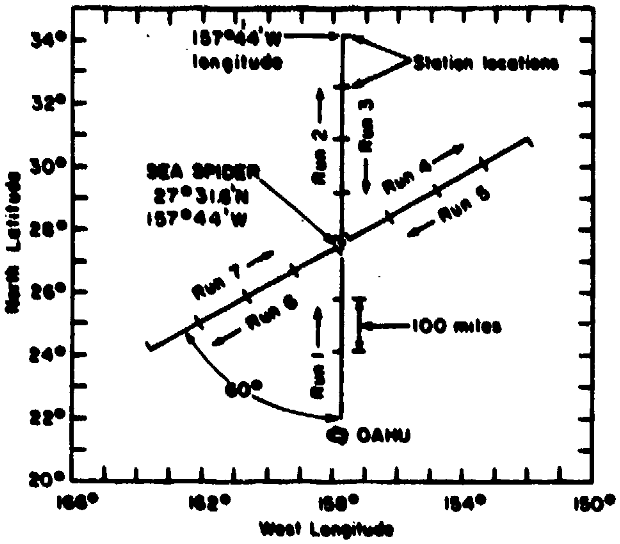
Day	Date	Time	Event
64	16 Sep	1600	Arrive SEA SPIDER with CONRAD. Occupy station at SEA SPIDER.
64	16 Sep	2400	Start EVENT 9 Run 2: 000°T. Occupy stations at 100, 200, and 300 mi.
67	19 Sep	0600	End Run 2 at 400 mi north of SEA SPIDER. Occupy station.
67	19 Sep	1200	Begin EVENT 9 Run 3 180°T. Occupy stations at 300, 200, and 100 mi.
69	21 Sep	2000	End Run 3 at SEA SPIDER. Occupy station.
70	22 Sep	0200	Start EVENT 9 Run 4: 060°T. Occupy stations at 100, 200 and 300 mi.
72	24 Sep	1000	End Run 4 EVENT 9 at 400 mi 060°T from SEA SPIDER. Occupy station.
72	24 Sep	1600	Begin EVENT 9 Run 5: 240°T. Occupy stations at 300, 200, and 100 mi.
74	26 Sep	2400	End Run 5 at SEA SPIDER. Occupy station.
75	27 Sep	0600	Start EVENT 9 Run 6: 240°T. Occupy stations at 100, 200 and 300 mi.
77	29 Sep	1400	End Run 6 at 400 mi 240°T from SEA SPIDER. Occupy station.
77	29 Sep	2000	Start EVENT 9 Run 7: 060°T. Occupy stations at 300, 200 and 100 mi.
80	2 Oct	0400	End Run 7 at SEA SPIDER. Depart for Pearl Harbor.

Day	Date	Time	Event
81	3 Oct	1800	Arrive Pearl Harbor.
PHASE IV			
86	8 Oct	0800	Depart Pearl Harbor.
86	8 Oct	2000	Start EVENT 11 Run 1 000°T from 22°N 157°44'W 12 hours before CONRAD. Occupy stations at -200 and -100 mi.
88	10 Oct	1600	Arrive SEA SPIDER with CONRAD. Occupy station.
88	10 Oct	2200	Start EVENT 11 Run 2: 000°T. Occupy stations at 100, 200 and 300 mi.
90	13 Oct	0600	End Run 2 at 400 mi north of SEA SPIDER. Occupy station.
90	13 Oct	1200	Begin EVENT 11 Run 3: 180°T. Occupy stations at 300, 200, and 100 mi.
93	15 Oct	2000	End Run 3 at SEA SPIDER. Occupy station.
94	16 Oct	0200	Start EVENT 11 Run 4: 060°T. Occupy stations at 100, 200 and 300 mi.
96	18 Oct	1000	End Run 4 at 400 mi 060°T from SEA SPIDER. Occupy station.
96	18 Oct	1600	Begin EVENT 11 Run 5: 240°T. Occupy stations at 300, 200, and 100 mi.
98	20 Oct	2400	End Run 5 at SEA SPIDER. Occupy station.

Day	Date	Time	Event
99	21 Oct	0600	Start EVENT 11 Run 6: 240°T. Occupy stations at 100, 200 and 300 mi.
101	23 Oct	1400	End Run 6 at 400 mi 240°T from SEA SPIDER. Occupy station.
101	23 Oct	2000	Start EVENT 11 Run 7: 060°T. Occupy stations at 300, 200, and 100 mi.
104	26 Oct	0400	End Run 7 at SEA SPIDER. Occupy Station.
104	26 Oct	1000	Start EVENT 11 Run 8: 180°T. Occupy station at -100.
105	27 Oct	1200	End Run 8 at 200 mi south of SEA SPIDER. Occupy station.
105	27 Oct	1800	Proceed to Pearl Harbor.
106	28 Oct	-	Arrive Pearl Harbor.
PHASE V			
113	3 Nov	2000	Depart Pearl Harbor.
114	5 Nov	0200	Arrive EVENT 12 station 1. Occupy stations along track from 24°45'N 157°44'W to 35°45'N 157°44'W at points approximately halfway between CONRAD and SEA SPIDER.
127	18 Nov	-	Depart last station at 35°45'N 157°44'W.
131	22 Nov	-	Arrive Pearl Harbor.

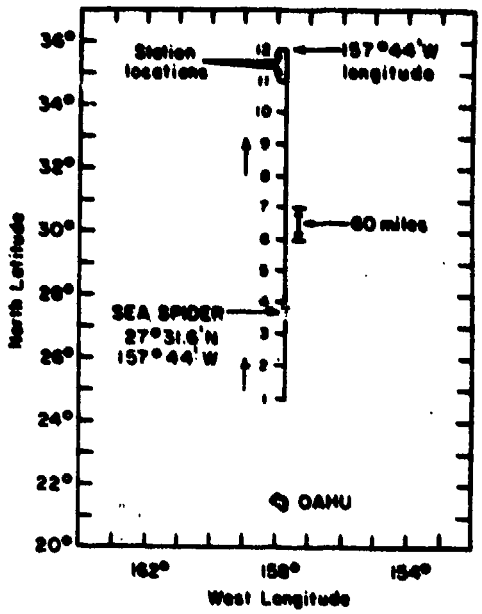
MARYSVILLE TRACK CHART

PHASE III



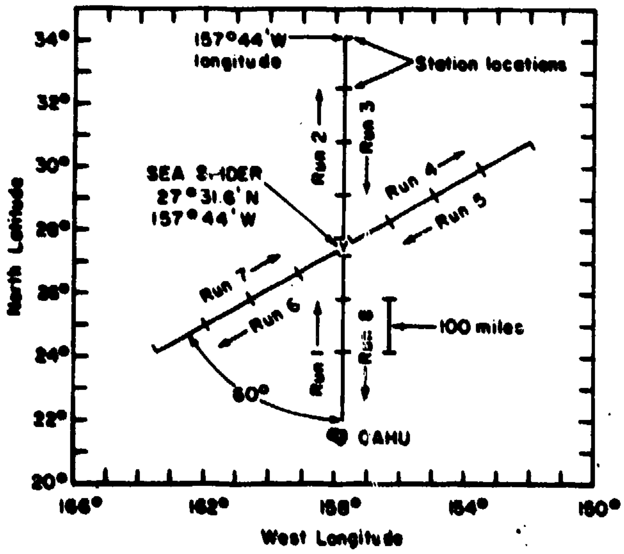
Notes:
1. Stations at −200 & −100 miles on Run 1
2. Stations at 0, 100, 200, & 300 miles on Runs 2, 4, & 6
3. Stations at 400, 300, 200, & 100 miles on Runs 3, 5, & 7

PHASE V



Notes:
1 Phase V track: 660 miles long
2 18-hour stations 60 miles apart

PHASE IV



Notes:
1. Stations at −200 & −100 miles on Run 1
2 Stations at 0, 100, 200, & 300 miles on Runs 2, 4, & 6
3 Stations at 400, 300, 200, & 100 miles on Runs 3, 5, & 7
4. Stations at 0, −100, & −200 on Run 8

e. USS REXBURG Schedule (C)

Day	Date	Time	Event
70	22 Sep	0800	Depart San Diego.
80	2 Oct	0800	Arrive Pearl Harbor.

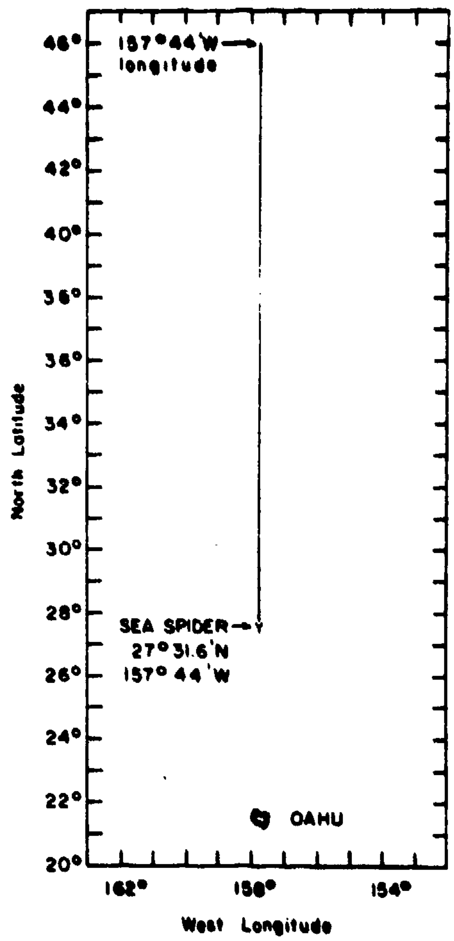
PHASE IV

Day	Date	Time	Event
85	7 Oct	1800	Depart Pearl Harbor.
86	8 Oct	0800	Begin EVENT 11 Run 1 Thermistor Chain tow from 22°N 157°44'W 000°T 24 hours before CONRAD.
88	10 Oct	1600	End Run 1 at SEA SPIDER. Start EVENT 11 Run 2: 000°T.
91	13 Oct	0600	End Run 2. Start EVENT 11 Run 3: 180°T.
93	15 Oct	2000	End Run 3 at SEA SPIDER. Start EVENT 11 Run 4: 060°T.
96	18 Oct	1000	End Run 4. Start EVENT 11 Run 5: 240°T.
98	20 Oct	2400	End Run 5 at SEA SPIDER. Start EVENT 11 Run 6: 240°T.
101	23 Oct	1400	End Run 6. Start EVENT 11 Run 7: 060°T.
104	26 Oct	0400	End Run 7 at SEA SPIDER. Start EVENT 11 Run 8: 180°T.
106	28 Oct	1100	End Run 8. Depart for Pearl Harbor.
106	28 Oct	2100	Arrive Pearl Harbor. End PHASE IV.

Day	Date	Time	Event
PHASE V			
113	4 Nov	0800	Depart Pearl Harbor.
114	5 Nov	1900	Begin EVENT 12: thermistor chain tow 000°T from SEA SPIDER.
122	13 Nov	1200	End thermistor chain tow at 46°N 157°44'W. Depart for Pearl Harbor.
128	19 Nov	1400	Arrive Pearl Harbor.

REXBURG TRACK CHART

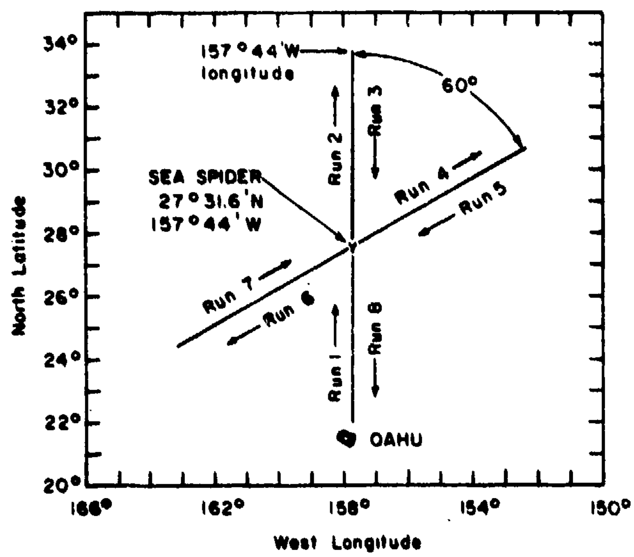
PHASE V



Note:

Phase V track: approx 1110 miles long

PHASE IV



Notes:

1. Runs 1 & 8: 330 miles long
2. Runs 2-7: approx 372 miles long

f. R/V MAHI Schedule (U)

Day	Date	Time	Event
49	1 Sep		Depart Honolulu
51	3 Sep	1600	Arrive SEA SPIDER - monitor SEA SPIDER surface buoy and HF
PHASE III			
58	10 Sep	2200	Depart SEA SPIDER
60	12 Sep		Arrive Honolulu
79	1 Oct		Depart Honolulu
81	3 Oct	0400	Arrive SEA SPIDER
PHASE IV			
86	8 Oct	2200	Depart SEA SPIDER
88	10 Oct		Arrive Honolulu
104	26 Oct		Depart Honolulu
106	28 Oct	0800	Arrive SEA SPIDER
PHASE V			
113	4 Nov	2200	Depart SEA SPIDER
[illegible]	6 Nov		Arrive Honolulu
136	27 Nov		Depart Honolulu
138	29 Nov	1800	Arrive SEA SPIDER

g. M/V RIGBUILDER Schedule (U)

Day	Date	Time	Event
16	30 Jul	-	Depart Santa Barbara
25	8 Aug	-	Arrive Pearl Harbor
29	12 Aug	0800	Depart Pearl Harbor
31	14 Aug	0000	Arrive SEA SPIDER site
31	14 Aug	0500	SEA SPIDER implantment (EVENT 3)
45	28 Aug	-	Depart SEA SPIDER - installation complete
47	30 Aug	-	Arrive Pearl Harbor

2. Aircraft Operations (C)

a. General

P3A or equivalent aircraft furnished by COMFAIRWING TWO will obtain AXBT (Airborne Expendable Bathythermograph) data every 25 miles along particular tracks in Phases III, IV and V. During the loss and arrival structure experiments in Phase III, a series of 300 and 600 mile legs will be flown by the aircraft dropping AXBT's every 25 miles (SAX flights), concurrent with the acoustic measurements on each track. There are a total of four tracks during this phase as shown in the track charts in Section 1 above, each requiring one aircraft run. During Phase IV, the same four tracks will be run, one leg per track.

During Phase V, the aircraft will drop MK 61 SUS charges as well as AXBT's for the long range propagation loss studies along great circle tracks from SEA SPIDER to Adak, San Diego, Alaska (due north) and Seattle (LAC flights). The charges will be dropped every two minutes (approximately every eight miles), indexed on the hour, along the track and will be set to detonate at 60 feet on the legs going away from SEA SPIDER and 800 feet on the legs returning to SEA SPIDER. The charge to be dropped on the hour will be eliminated. AXBT's will be dropped on the outward legs only.

b. Phase III - Short Range Aircraft Schedule

Flight Nr.	First AXBT Drop Date/Time	Initial Heading (°T)	CONRAD - Distance From SEA SPIDER
SAX 31	151200(W) SEPT	180	290 NMi
SAX 33	201200(W) SEPT	000	340 NMi
SAX 35	251200(W) SEPT	060	360 NMi
SAX 37	301200(W) SEPT	240	400 NMi

Notes:

1. All runs start at SEA SPIDER

2. AXBT drops at 25 nautical mile spacing

c. PHASE IV - Short Range Aircraft Schedule

Flight Nr.	First AXBT Drop Date/Time	Initial A/C Heading (°T)	CONRAD - Distance From SEA SPIDER
SAX 41	091200(W) OCT	180	290 NMi
SAX 43	141200(W) OCT	000	340 NMi
SAX 45	191200(W) OCT	060	360 NMi
SAX 47	241200(W) OCT	240	400 NMi

Notes:

1. All runs start at SEA SPIDER

2. AXBT drops at 25 nautical mile spacing

d. PHASE V - Long Range Aircraft Schedule

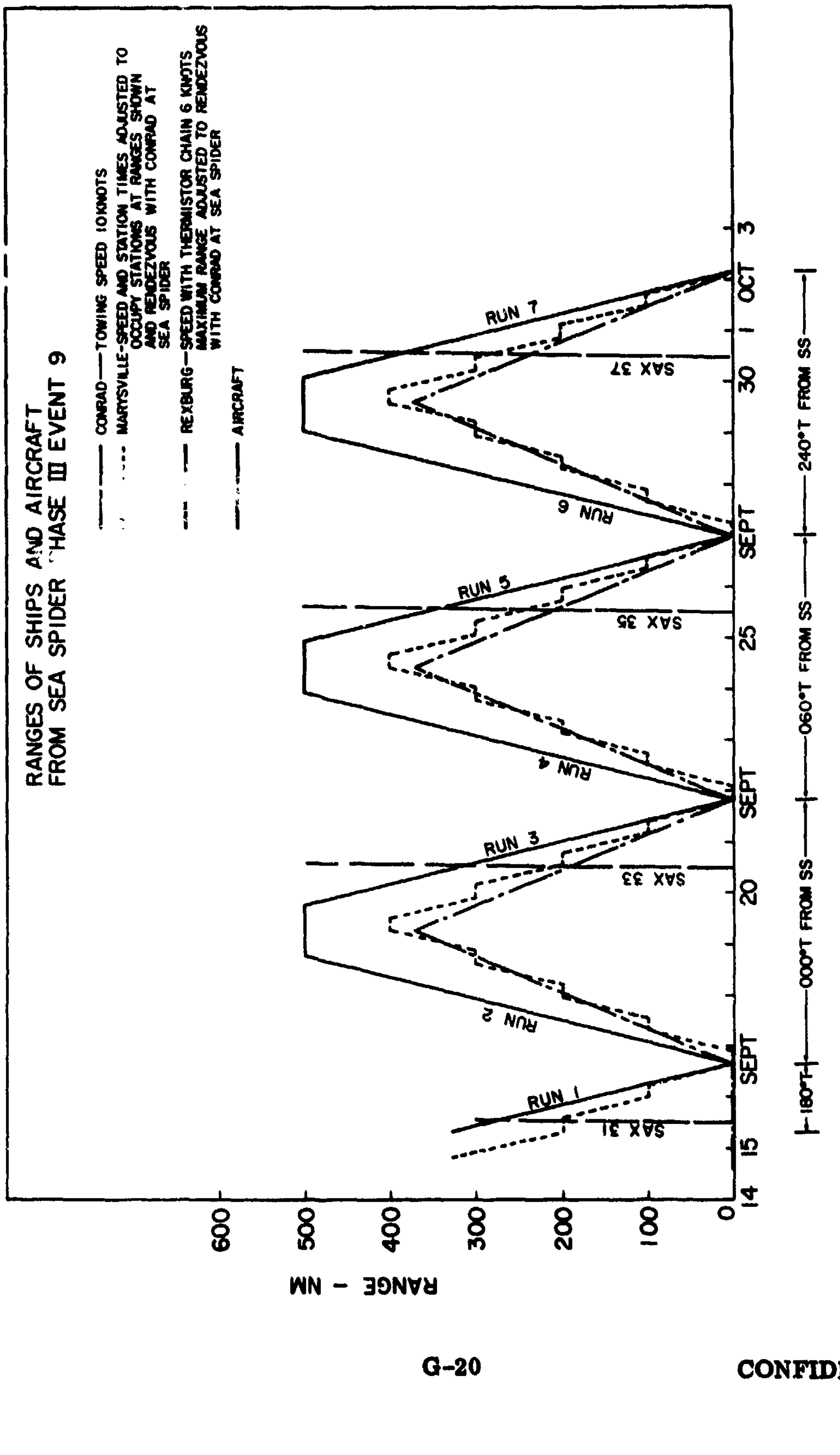
Flight Nr.	First Drop Date/Time	Start Run Position	End Run Position
LAC 51	050800(W)NOV	SEA SPIDER	51°55'N 176°34'W
LAC 52	070800(W)NOV	51°55'N 176°34'W	SEA SPIDER
LAC 53	110800(W)NOV	SEA SPIDER	32°43'N 117°12'W
LAC 54	130800(W)NOV	32°43'N 117°12'W	SEA SPIDER
LAC 55	180800(W)NOV	SEA SPIDER	55°00'N 157°44'W
LAC 56	200800(W)NOV	55°00'N 157°44'W	SEA SPIDER
LAC 57	240800(W)NOV	SEA SPIDER	48°17'N 122°37'W
LAC 58	260800(W)NOV	48°17'N 122°37'W	SEA SPIDER

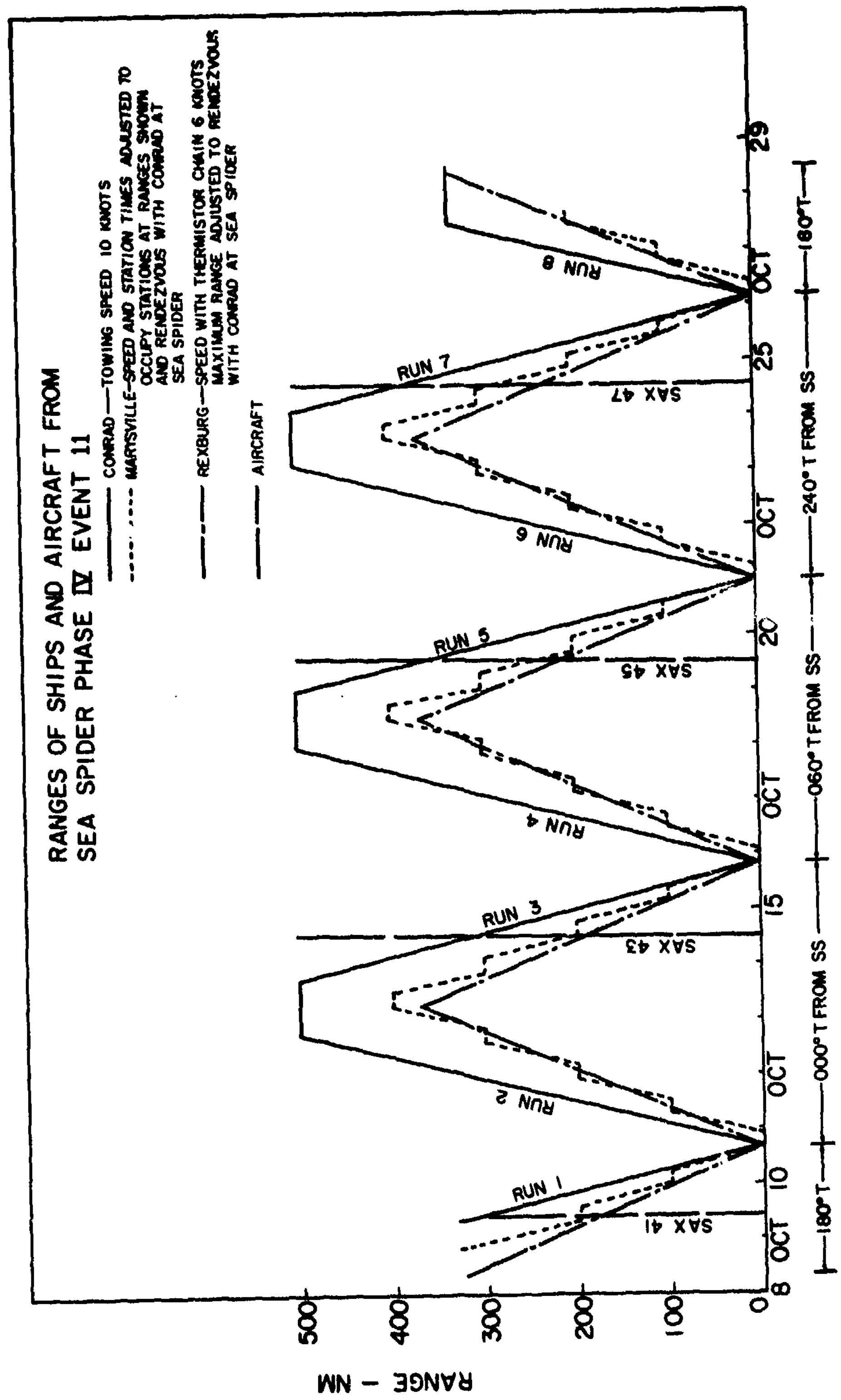
Notes:

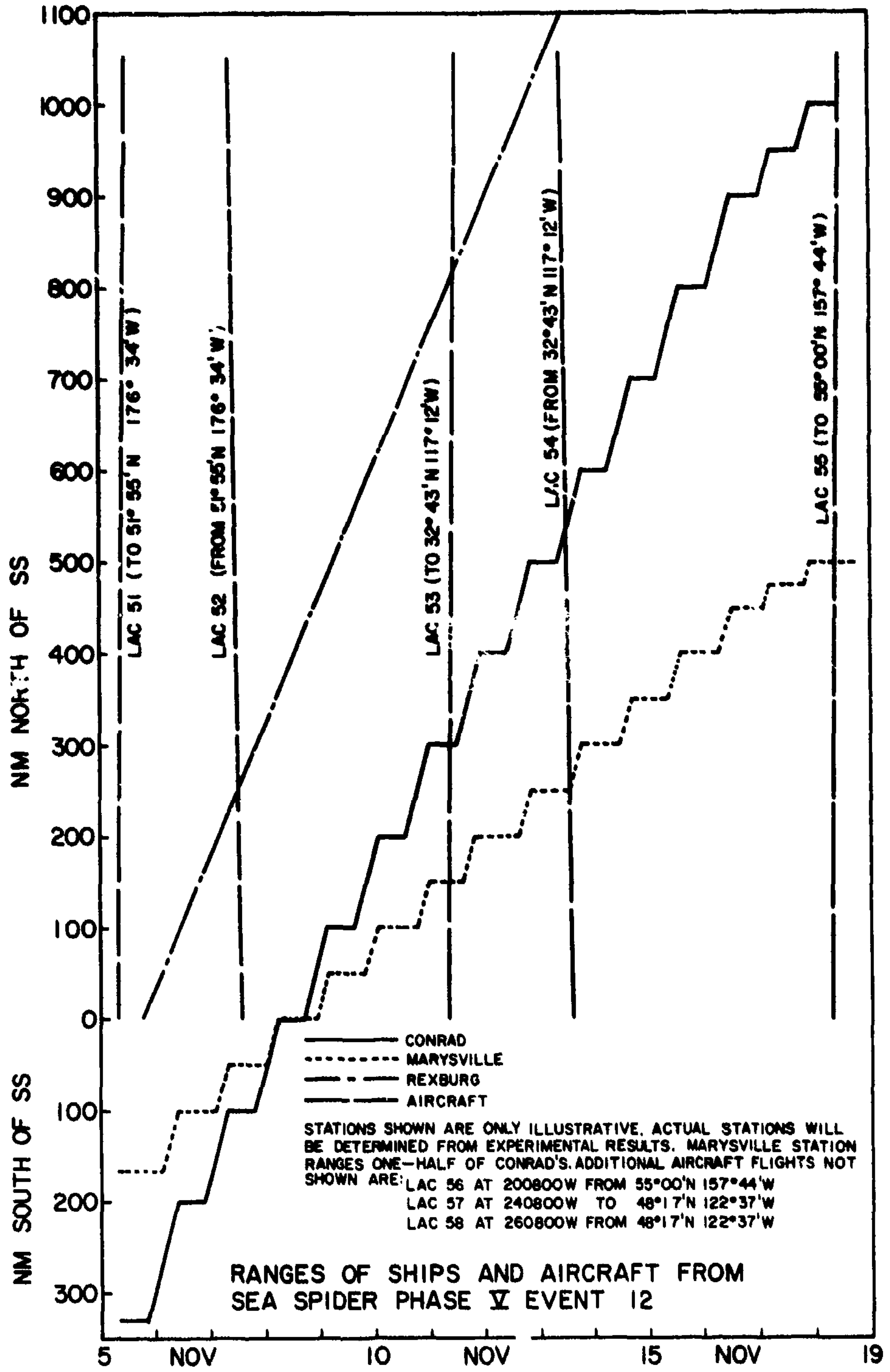
1. AXBT's at 25 nautical mile spacing on outbound legs only.

2. MK 61 SUS charges at 60' outbound from SEA SPIDER; at 800' inbound to SEA SPIDER

3. SUS charges to be dropped on two minute intervals on all runs with the drop on the hour omitted.


RANGES OF SHIPS AND AIRCRAFT
FROM SEA SPIDER PHASE III EVENT 9
CONRAD—TOWING SPEED 10KNOTS
MARYSVILLE—SPEED AND STATION TIMES ADJUSTED TO OCCUPY STATIONS AT RANGES SHOWN AND RENDEZVOUS WITH CONRAD AT SEA SPIDER
REXBURG—SPEED WITH THERMISTOR CHAIN 6 KNOTS. MAXIMUM RANGE ADJUSTED TO RENDEZVOUS WITH CONRAD AT SEA SPIDER
AIRCRAFT
RUN 1
RUN 2
RUN 3
RUN 4
RUN 5
RUN 6
RUN 7
SAX 31
SAX 33
SAX 35
SAX 37
RANGE – NM
0
100
200
300
400
500
600
14
15
SEPT
20
SEPT
25
SEPT
30
1
OCT
3
180°T
000°T FROM SS
060°T FROM SS
240°T FROM SS


RANGES OF SHIPS AND AIRCRAFT FROM
SEA SPIDER PHASE IV EVENT 11
CONRAD — TOWING SPEED 10 KNOTS
MARYSVILLE — SPEED AND STATION TIMES ADJUSTED TO OCCUPY STATIONS AT RANGES SHOWN AND RENDEZVOUS WITH CONRAD AT SEA SPIDER
REXBURG — SPEED WITH THERMISTOR CHAIN 6 KNOTS. MAXIMUM RANGE ADJUSTED TO RENDEZVOUS WITH CONRAD AT SEA SPIDER
AIRCRAFT
RUN 1
RUN 2
RUN 3
RUN 4
RUN 5
RUN 6
RUN 7
RUN 8
SAX 41
SAX 43
SAX 45
SAX 47
RANGE — NM
0
100
200
300
400
500
8 OCT
10
OCT
15
OCT
20
OCT
25
OCT
29
180°T
000°T FROM SS
060°T FROM SS
240°T FROM SS
180°T



RANGES OF SHIPS AND AIRCRAFT FROM SEA SPIDER PHASE V EVENT 12

ANNEX H

COMMUNICATIONS

1. (U) General.

Radio voice communications among all ships and the Operation Control Center (OCC) will be established on specified frequencies assigned to the PARKA Experiment. Approval of requested frequencies for PARKA II is expected by 1 July. Of the frequencies requested one will be assigned as "Primary Scientific Net" frequency and one assigned as "Secondary Scientific Net" frequency. Other frequencies will be assigned for communications with support aircraft and as backup for long range ship communications. When frequencies are approved for use in the PARKA II Experiment, scientific radio equipment to be installed in ships will be wired for the approved frequencies. Net control of all assigned frequencies will be exercised by the OCE at the Operations Control Center (OCC). Identification of these nets, backup nets, and frequencies will be made in the Operations Order promulgated by COMASWFORPAC.

2. (U) Scientific Radio Net.

The equipment used for the Scientific Radio Net will be furnished to all participants by the University of Hawaii Institute of Geophysics. Mr. Noel Thompson will coordinate the installation of this equipment and the testing of the net prior to Phase III of the PARKA II Experiment.

3. (U) Call Signs.

Call signs for ships, activities and task organizations will be included in Operation Order promulgated by COMASWFORPAC.

4. (C) Communications Security.

a. Security guidance directives for SEA SPIDER and PARKA II, summarized in Annex I, require that classified information associated with this experiment be properly safeguarded to prevent compromise. The items to be protected include the following:

(1) Acoustic propagation loss versus range.

(2) Acoustic source size and depth.

(3) Acoustic source, type, mode and interval of operation.

b. To provide security for the above information and common terminology for certain actions, the following procedures are to be implemented in PARKA II:

(1) Brevity Code Words - Brevity Code Words will be provided for use as substitutes for significant actions and events. The purpose of brevity code words is to provide a common method of referring to significant actions and not in themselves to provide security protection. However, when used with the encryption system discussed below, they do provide security protection. These words will change each phase during phases III, IV, V.

(2) Encryption System - The MEDEA Crypto System will be used to encrypt significant numerical values which, although not classified in themselves, become classified when used with certain brevity code words. Of particular concern is the CONFIDENTIAL information associated with source type, size, depth and interval, as well as frequency of interest. COMASWFORPAC will issue the MEDEA system to selected personnel for the PARKA II Experiment.

(3) Reference Graphs - Reference graphs will be used to pass transmission loss data between the Chief Scientist at OCC and Deputy Chief Scientist on SANDS. A separate set of graphs will be prepared for each of the acoustic phases, (Phases III, IV, V), of the PARKA II Experiment. The Chief Scientist will prepare two copies of each graph for each phase; one copy to be held by the Deputy Chief Scientist and one by the Chief Scientist.

(4) Configuration Tables - The graphs will be supplemented by a set of configuration tables for each phase. These tables, with the reference graphs, provide the Chief Scientist and Deputy Chief Scientist with a common reference for comparing transmission loss data. The configuration tables identify the specific hydrophone of interest, depth and type of source and frequency under consideration. The configuration table will change for each acoustic phase of the experiment.

c. Brevity code words and configuration tables will be promulgated by a special annex (Annex M) to MARYSVILLE, CONRAD, SANDS and the OCC.

5. (U) Communications Backup

Auxiliary communications equipment, other than that supplied for the Scientific Net, is installed in all ships and activities as part of its regular communications equipment. In the event of a communication failure by a participant, all effort should be made to restore communications in the most expeditious manner.

ANNEX I

SECURITY CLASSIFICATION

1. General guidance.

a. Any Statement of the objectives of the PARKA Experiments which relates to the objectives of existing or planned systems is GROUP 1 SECRET.

b. The cover for the Experiment - combined oceanographic and acoustic observations over a broad ocean area - is UNCLASSIFIED.

c. This Scientific Plan is divided into sections of different levels of classification. It is intended to be distributed in sections to the various participating ships, facilities, laboratories, and individuals on a need-to-know basis. Transmission, discussion, and stowage of the entire operation plan or sections thereof will be in accordance with existing security regulations.

d. Pacific Acoustic Research Kaneohe-Alaska Experiment and acronym PARKA II is UNCLASSIFIED.

2. Data and reports.

a. Acoustic data such as transmission loss, level vs. distance information, depth and source level of sound sources, including charge size, will be GROUP 1 CONFIDENTIAL. Raw acoustic data such as Sanborn records, magnetic tapes of shot arrivals and/or projector signals, shot times and shot arrival times will be UNCLASSIFIED. Voice or CW transmission of information between ships and facilities engaged in acoustic exercises will be appropriately coded as directed by the communication annex of this Operation Plan. Care will be taken to ensure that there be no coupling of unclassified raw data to data which would result in compromising the acoustic portion of this experiment. Any proposals for changing the classification of portions of acoustic data will be individually considered on a case-by-case basis.

b. The following types of data taken during the experiment are UNCLASSIFIED: Temperature, salinity, density vs. depth; bathythermograph data; thermistor chain data;

sound velocity profile data; bathymetric data; sub-bottom profile data; other geological and geophysical data; weather and sea-surface observations.

c. Environmental data reports or other publications which do not relate environmental effects to acoustic phenomena obtained during the Experiment are UNCLASSIFIED.

d. Data reports which include information such as dates, times, or positions which can be used to reconstruct any of the acoustic portions of the Experiment will be classified GROUP 4 CONFIDENTIAL.

e. The PARKA Experiment Final Report will be classified in accordance with other guidance in this annex.

f. All reports, documents, or messages which discuss the implications of the phenomena under study with respect to the performance of existing or planned systems will be classified GROUP 1 SECRET or CONFIDENTIAL as may be required.

3. Schedules and positions.

a. Diagrams or schedules which indicate names or numbers of all participating ships and aircraft of the entire Experiment are GROUP 4 CONFIDENTIAL.

b. Position of source and listening ships prior to the acoustic tests will be GROUP 1 CONFIDENTIAL. These positions will be UNCLASSIFIED upon commencement of the test. Transmission of position by voice or CW prior to commencement of the tests will be appropriately coded as directed by the communication annex of this Operation Plan.

c. Individual ship schedules (except U.S. Navy ships) are UNCLASSIFIED. Schedules of U.S. Navy ships will be classified in accordance with current orders.

4. SEA SPIDER.

a. SEA SPIDER as a name and all aspects of it as a stable, deep ocean moored platform and as an oceanographic research tool is UNCLASSIFIED.

b. Specific details of the intended method of application and design of SEA SPIDER and its present and future acoustic capabilities and performance as they relate to system performance and possible future improvements thereto will be classified GROUP 1 SECRET or CONFIDENTIAL as may be required.

c. Additional security classification criteria for SEA SPIDER are provided in Chief of Naval Research letter Serial 00456 of 21 April 1969.

PARKA II
ONR SCIENTIFIC PLAN 2-69
ANNEX J

LOGISTICS

1. Introduction. The responsibility for ship/activity logistics is that of the Senior Scientist on Board (SSOB) each ship or at each activity participating in the PARKA II Experiment. The PARKA II Project Coordinator is responsible for the overall logistics plan as related to the successful carrying out of the operations. The following paragraphs describe the salient logistics factors involved and certain special arrangements. This annex also contains a Technical Staff and Senior Scientist on Board directory in order to facilitate communications between participants.

2. Special Arrangements. Arrangements are being made with COMASWFORPAC for special services to CONRAD and RIGBUILDER if, because of time limitations, normal services are not available from commercial sources. In addition, berthing for RIGBUILDER and SANDS is planned for Pier F-1, adjacent to ASWFORPAC headquarters. A large open area at the pier is available for rigging, cable winding, etc., and a secure warehouse is available for storage of special equipment. A briefing room is also available for pre-implantment briefing sessions. Office space is available at headquarters for transient scientists during in-port periods.

3. Base Passes. Base passes are required for personnel having duty on Ford Island. In order to have base passes available for these personnel, forms have been sent to each non-Navy participating activity to be filled out and submitted in advance of arrival. Two copies of standard size pass photos will be required to accompany the form.

4. Transportation. Transportation to and om Ford Island is available. Frequent trips are made by ferry and personnel boats. SANDS will also provide boat service when berthed at Ford Island.

5. Special Services. A contingency fund will be set up with ASWFORPAC in order to handle special purchases or base services such as shop work, cranes, etc. Contact the Project Coordinator, Mr. A. J. Hiller, if any special requirements occur.

6. Expendables. AXBT's, XBT's, TNT charges and SUS charges have been ordered by ONR and NAVOCEANO. Pre-deployment of some of these to Adak, Kodiak, Seattle and San Diego is being arranged. For local supply, the AXBT's will be located at Barbers Point, the XBT's at Ford Island and the explosives at the Naval Ammunition Depot, Pearl Harbor. SSOB's are requested to make arrangements with the Project Coordinator for timely delivery of these to their ships well in advance of departure times.

7. Scientific Radio Net. Hawaii Institute of Geophysics (HIG) will coordinate installation and check out of scientific radio net communications systems in all PARKA units.

8. Shipping and Receiving Supplies. All equipment shipped to Hawaii for the PARKA Experiment should be addressed as follows:

Commanding Officer
U. S. Naval Supply Center
U. S. Naval Base
Pearl Harbor, Hawaii
Attn: Mrs. Aggie Chun, Code 11S

Mark packages: "Hold for SEA SPIDER Project, (PARKA EXPERIMENT)"

Mrs. Chun's telephone number:
808-433-8433

Shipments and personal mail may also be sent in care of:

Mr. G. E. Schafer
University of Hawaii Ocean Marine Facility
405A Nimitz Highway (Pier 18)
Honolulu, Hawaii 96813

The Ocean Marine Facility also has storage space available for use by the PARKA II participants. Those requiring this service should contact Mr. Schafer.

PARKA II TECHNICAL STAFF DIRECTORY

NAME	TITLE	ADDRESS & PHONE NO.
Dr. J. Brackett Hersey	LRAP Project Manager	Office of Naval Research, Code 102-OS Washington, D. C. 20360 202-767-2844
Dr. Rudolph H. Nichols	Chief Scientist PARKA II	Bell Telephone Labs. Whippany, N. J. 07981 201-386-3535
Mr. Raymond W. Hasse	Deputy Chief Scientist PARKA II	Navy Underwater Sound Lab., New London, Conn. 06320 203-442-0771 X2420
Mr. Alexander J. Hiller	Project Coordinator	Code 8030 U.S. Naval Research Lab., Wash., D. C. 20390 202-767-2745
Mr. Kenneth W. Lackie	Scientist in Charge of Oceanographic Operations	Code 037 U.S. Naval Oceanographic Office Wash., D. C. 20390 202-767-2525
LT E. Eugene Flesher	ASWFORPAC PARKA II Liaison Officer	ASWFORPAC FPO San Francisco, Calif. 96610 808-433-8717
LCDR A. Spousta	Air Support Liaison Officer	ASWFORPAC FPO San Francisco, Calif. 96610 808-433-8242
Mr. Noel J. Thompson	Radio Communications, Telemetry and Data Processing	Hawaii Institute of Geophysics Honolulu, Hawaii 96822 808-944-8790
Mr. John B. Gregory	SEA SPIDER Project Manager	Office of Naval Research, Code 485 Wash., D. C. 20360 202-767-2848

Parka II Technical Staff Directory Continued:

NAME	TITLE	ADDRESS & PHONE NO.
Mr. Robert H. Luten	Radiological Safety Engineer (NAVFACENGCOM)	U. S. Naval Nuclear Power Unit P. O. Box 96 Fort Belvoir, Va. 22060 703-664-6316

SENIOR SCIENTIST DIRECTORY

SHIP	NAME	ADDRESS AND PHONE
USNS SANDS	Robert L. Martin, NUSL	New London, Conn. 06320 203-442-0771 X2832
R/V CONRAD	John I. Ewing Lamont-Dohert Geological Observatory	Palisades, N. Y. 10964 914-359-2900 X234
R/V MAHI	Leonard Knowles University of Hawaii HIG	Honolulu, Hawaii 96825 808-944-7154
USS MARYSVILLE	Richard C. Latham, HIG University of Hawaii	Honolulu, Hawaii 96825 808-944-8762
USS REXBURG	Kenneth W. Nelson, Code 504, NURDC	San Diego, Calif. 92132 714-222-6311 X429
GM RIGBUILDER	Richard R. Swenson, General Motors	Defense Research Labs. Santa Barbara, Calif. 93101 805-968-1011

ANNEX K

REPORTS

1. General. The preparation of a technical report on the scientific results of the PARKA II Experiment, for publication as soon as possible after completion of the experiment, will be the joint responsibility of the Chief Scientist and Deputy Chief Scientist. In order to make the immediately obvious results of the experiment available as soon as possible, the preparation of a brief report for each phase will also be attempted.

2. Requirements. Office space and desks, files, etc., along with stenographic services for a group of five to eight people will be available at the Operation Control Center location during the performance of the experiment. Wall space and table space for mounting charts and data graphs for observation and examination will also be available.

3. Procedures. The participating laboratories will submit individual reports pertaining to specific portions of the experiment. These may include acoustic data reports, oceanographic data reports or reports relating to acoustic modeling. Individual cruise reports from each participating vessel outlining in general the type of work, problems involved and recommendations for future operations of this sort will be submitted by the Senior Scientist on board (SSOB) each vessel upon completion of each ship's participation in the exercise. In order to facilitate and expedite the preparation of the cruise report, the SSOB will keep a daily log of relevant operations and events.

4. Review and Classification. All reports shall be reviewed by the Deputy Assistant Oceanographer of the Navy for Ocean Science and classified appropriately prior to distribution. Classification of these cruise reports will be in accordance with appropriate Annexes of this Scientific Plan.

5. Operational Reports. The following reports are required at various frequencies throughout the experiment to keep interested commands and activities informed of the progress of the experiment or to report unusual occurances:

a. Divers' Daily Situation Report

The Divers' Daily Situation Report is made to ONR Codes 102-OS, 400C and 485 via the SSOB on SANDS and the OCE to provide ONR with general information about the operation of the SEA SPIDER and its monitoring systems. The results of diver inspections (at 2-3 week intervals) of the SEA SPIDER moor which reveal no abnormalities will be included in this daily situation report and will provide the following about the inspections:

(1) Degree of marine fouling on moor.

(2) prevalence of sharks.

(3) Significant diver difficulties.

(4) Monitoring equipment malfunctions.

Diver inspections which reveal abnormalities of the moor will be made by Casualty Report. (See Section IIE3)

b. Casualty Reports

Casualty Reports are made by the diver/technician to ONR Codes 102-OS, 400C, and 485 via the SSOB on SANDS and the Chief Scientist at the OCC for recommendations. Casualty reports define a serious situation with the SEA SPIDER moor which impairs its integrity or operation. The courses of action to be taken to repair the casualty reported must await a determination by the ONR SEA SPIDER Project Manager. Details related to this report are found in Section IIE3.

c. OCE Daily Situation Report

In order to inform operational commands and the Office of Naval Research management codes, the OCE will make a daily situation report. This report will summarize status of the PARKA II experiment on a day-by-day basis and will include salient items related to ship movements, schedules, and general conduct of operations. In some cases, the Chief Scientist and Project Coordinator will provide information related to the conduct of the experiment and scientific goals accomplished.

d. <u>Chief Scientist's Message Report</u>

The Chief Scientist will provide the LRAP Project Manager (ONR Code 102-OS) with a brief evaluation of the scientific results and problems encountered at the end of each phase of the experiment. This message report is a quick look at the accomplishments of a phase, to keep the LRAP Project Manager informed, and is in addition to the brief report to be prepared at the end of each phase described in paragraph 1 above. During the course of an experimental phase, the Chief Scientist may report significant items which, in his opinion, are of interest to the LRAP Manager.

e. <u>SUS Charge Performance Report</u>

The SSOB on SANDS will report on the performance of the Mk 61 SUS charges dropped during the long range A/C runs conducted during EVENT 13, Phase V. The report will contain performance of the charges based on signal reception at SANDS and will include the following information: good shots, duds, apparent malfunction in detonation depth, and deviations from expected source level. This report will be submitted at the end of Phase V to the Project Coordinator who will forward it to the cognizant NAVAIRSYSCOM Code. (See Annex E, page 23)

PARKA II
ONR SCIENTIFIC PLAN 2-69

ANNEX L

DATA PLOT FORMATS (U)

1. Introduction. In order to simplify intercomparison of various sets of data, and to have data plotted to scales suitable for a preliminary report, the following formats will be used unless otherwise requested by the Chief Scientist.

2. Acoustic Data Plot Formats.

a. On-line plots of transmission loss vs. range for the long range experiments covering a range of 1000 to 2500 nautical miles shall be plotted in the following manner: transmission loss in decibels, increasing downward, on the ordinate scale, 10 db per inch; range of the source from SEA SPIDER, in nautical miles, on the abscissa scale, 200 n. mi. per inch.

b. For the short range acoustic runs of 300 to 500 miles length, the scales shall be 10 db/inch for transmission loss and 50 n. mi./inch for range.

c. Plots of predicted or computed transmission loss vs. range shall also conform to the above formats.

d. Plots showing transmission loss as a function of time shall be plotted on an ordinate scale of 10 db per inch with time on the abscissa to a scale of 1 hour per 1.2 inches.

3. Environmental Data Plot Formats.

a. XBT's, AXBT's and other data shallower than 1000 meters depth shall be plotted to the following scales: sound velocity on the abscissa to a scale of 20 m/sec per inch; depth on the ordinate to a scale of 100 meters per inch, total scale length 10 inches (1000 m.).

b. Velocimeter or STD data deeper than 1000 meters depth shall be plotted on the following scales: sound velocity on the abscissa to a scale of 20 m/sec per inch; depth on the ordinate to a scale of 500 meters per inch, total scale length 10 inches (5000 m.).

c. Displays showing each plot of sound velocity at a position along the abscissa which indicates the range at which it was taken relative to SEA SPIDER shall have a range scale of 20 n. mi. per inch along the abscissa.

d. Displays showing each plot of sound velocity vs. depth at a position along the abscissa which indicates the time at which it was taken shall have a time scale of 10 hours per inch along the abscissa.

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
800 NORTH QUINCY STREET
ARLINGTON, VA 22217-5660

IN REPLY REFER TO
5510/1
Ser 93/160
10 Mar 99

From: Chief of Naval Research
To: Commander, Naval Meteorology and Oceanography Command
1020 Balch Boulevard
Stennis Space Center MS 39529-5005

Subj: DECLASSIFICATION OF PARKA I AND PARKA II REPORTS

Ref: (a) CNMOC ltr 3140 Ser 5/110 of 12 Aug 97

Encl: (1) Listing of Known Classified PARKA Reports

1. In response to reference (a), the Chief of Naval Operations (N874) has reviewed a number of Pacific Acoustic Research Kaneohe-Alaska (PARKA) Experiment documents and has determined that all PARKA I and PARKA II reports may be declassified and marked as follows:

   Classification changed to UNCLASSIFIED by authority of Chief of Naval Research letter Ser 93/160, 10 Mar 99.

   DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

2. Enclosure (1) is a listing of known classified PARKA reports. The marking on those documents should be changed as noted in paragraph 1 above. When other PARKA I and PARKA II reports are identified, their markings should be changed and a copy of the title page and a notation of how many pages the document contained should be provided to Chief of Naval Research (ONR 93), 800 N. Quincy Street, Arlington, VA 22217-5660. This will enable me to maintain a master list of downgraded PARKA reports.

3. Questions may be directed to the undersigned on (703) 696-4619, DSN 426-4619.

Peggy Lambert
PEGGY LAMBERT
By direction

Copy to:
NUWC Newport Technical Library (Code 5441)
NRL Washington (Mary Templeman, Code 5227)
NRL SSC (Roger Swanton, Code 7031)
✓DTIC (Bill Bush, DTIC-OCQ)

LISTING OF KNOWN CLASSIFIED PARKA REPORTS

Operation Plan, Pacific Acoustic Research Kaneohe-Alaska PARKA Experiment, Undated, ONR, 48 pages
(NUSC NL Accession # 49531)

Fleet Research Project 109 PARKA II, Undated, COMASWFORPAC-OPORD-303-69, Antisubmarine Warfare Force, Pacific Fleet, Unknown # of pages
(NUSC NL Accession # 093561)

Preliminary Operation Plan Pacific Acoustic Research Kaneohe-Alaska PARKA Experiment, June 1968, ONR, Unknown # of pages
(NUSC NL Accession # 023063)

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Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
ARLTR7952	Focke, K. C., et al.	CHURCH STROKE 2 CRUISE 5 PAR/ACODAC ENVIRONMENTAL ACOUSTIC MEASUREMENTS AND ANALYSIS (U)	University of Texas, Applied Research Laboratories	791029	ADC025102; NS; AU; ND	C
Unavailable	Van Wyckhouse, R. J.	SYNBAPS. VOLUME I. DATA BASE SOURCES AND DATA PREPARATION	Naval Ocean R&D Activity	791201	ADC025193	C
NORDATN63	Brunson, B. A., et al.	ENVIRONMENTAL EFFECTS ON LOW FREQUENCY TRANSMISSION LOSS IN THE GULF OF MEXICO (U)	Naval Ocean R&D Activity	800901	ADC029543; ND	C
NORDATN80C	Gereben, I. B.	ACOUSTIC SIGNAL CHARACTERISTICS MEASURED WITH THE LAMBDA III DURING CHURCH STROKE III (U)	Naval Ocean R&D Activity	800915	ADC023527; NS; AU; ND	C
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HSECO735	Luehrmann, W. H.	SQUARE DEAL R/V SEISMIC EXPLORER FIELD OPERATIONS REPORT (U)	Seismic Engineering Co.	731121	AD0530744; NS; ND	C; U
MPL-C-42/76	Morris, G. B.	CHURCH ANCHOR EXPLOSIVE SOURCE (SUS) PROPAGATION MEASUREMENTS FROM R/P FLIP (U)	Marine Physical Laboratory	760701	ADC010072; AU; ND	C; U
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NORDAR23	Fenner, D. F.	SOUND SPEED STRUCTURE OF THE NORTHEAST ATLANTIC OCEAN IN SUMMER 1973 DURING THE	Naval Ocean R&D Activity	800301	ADC029546; NS; ND	C; U
NOOTR230	Bucca, P. J.	SOUND VELOCITY CONDITIONS DURING THE CHURCH ANCHOR EXERCISE (U)	Naval Oceanographic Office	751201	NS; AU; ND	C;U
ONR SP 2-69; MC PLAN-01	Unavailable	PARKA II EXPERIMENT UTILIZING SEA SPIDER, ONR SCIENTIFIC PLAN 2-69 (U)	Maury Center for Ocean Science	690626	ADB020846; ND	U
Unavailable	Unavailable	PARKA I EXPERIMENT	Maury Center for Ocean Science	691101	AD0506209	U
USRD CR 3105	Unavailable	SEA SPIDER TRANSPONDER TRANSDUCER	Naval Research Laboratory	700505	ND	U
MC PLAN 05; ONR Scientific Plan 1-71	Unavailable	ATLANTIC TEST BED MEASUREMENT PROGRAM (U)	Maury Center for Ocean Science	701020	ND	U
ACR-170 VOL.1	Hurdle, B. G.	PROJECT NEAT- A COLLABORATIVE LONG RANGE PROPAGATION EXPERIMENT IN THE NORTHEAST ATLANTIC, PART I (U)	Naval Research Laboratory	701118	ND	U
MC-003-VOL-2	Unavailable	THE PARKA I EXPERIMENT. APPENDICES- PACIFIC ACOUSTIC RESEARCH KANEOHE-ALASKA (U)	Maury Center for Ocean Science	710101	ND	U